# *City of LaPorte Lakes (Pine, Stone, Clear, and Lily)*
# *Aquatic Vegetation Management Plan*
# *2007-2011*
# *LaPorte County, Indiana*

February 13, 2008


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## Executive Summary

Aquatic Control was contracted by LaPorte City Parks and Recreation to complete aquatic vegetation sampling in order to create a lakewide, long-term integrated aquatic vegetation management plan for Pine, Stone, Lily, and Clear Lakes. The purpose of the plan is to more effectively document and control nuisance aquatic vegetation within the lakes.

Aquatic vegetation is an important component of Indiana Lakes. Aquatic vegetation provides fish habitat, food for wildlife, prevents erosion, and can improve overall water quality. However, as a result of many factors, aquatic vegetation can develop to a nuisance level. Nuisance aquatic vegetation, as used in this paper, describes plant growth that negatively impacts the present uses of the lake including fishing, boating, swimming, aesthetic, and lakefront property values. The primary nuisance species within the lakes is the invasive exotic plant Eurasian watermilfoil (*Myriophyllum spicatum*). The negative impact of this species on native aquatic vegetation, fish populations, water quality, and other factors is well documented and will be discussed in further detail.

In 2007, the Lake and River Enhancement (LARE) program along with LaPorte City Parks and Recreation funded plant sampling and treatment of milfoil on Pine, Stone, Lily, and Clear Lake (Harris Lake was removed from the study area due to a lack of navigable waters caused by a low water table). Sampling was completed on August 8 & 23 and consisted of an Invasive Species Mapping Survey along with a Tier II survey. Surveys indicated that Pine and Stone Lake had a relatively small milfoil infestation, Lily a moderate infestation, and Clear Lake had a severe infestation of Eurasian watermilfoil. Pine and Stone Lakes each had very abundant and diverse native submersed vegetation populations while Clear and Lily's native submersed vegetation was somewhat limited. Due to a delay in the contractor selection process, treatment was not completed until late summer. On August 23, 2007, a total of 27.0 acres of Eurasian watermilfoil was treated on three of the lakes (Pine 23.8 acres, Stone 0.5 acres, and Lily 2.7 acres). Renovate herbicide (active ingredient: triclopyr) was used in the treatment in order to selectively control Eurasian watermilfoil with little damage to beneficial native vegetation. Clear Lake was not treated even though it was, by far, the most impaired lake. A large treatment on Clear Lake in August may have led to a drop in dissolved oxygen levels resulting in a fish kill. In addition, there were not enough funds to make a significant impact on such a severe Eurasian watermilfoil infestation.

The primary recommendation for plant control within the lakes involves the continued use of systemic herbicides to selectively control Eurasian watermilfoil. Renovate herbicide should be used in Pine, Stone and Lily Lakes while Sonar (active ingredient: fluridone) should be applied to Clear Lake. These treatments should preserve and enhance the population of native vegetation. The goal of the treatments is to eliminate milfoil from the lakes. This may be a difficult goal to achieve due to the abundance of milfoil in other lakes within the watershed and immediate area. It is estimated that up to 20 acres of milfoil may require treatment in Pine Lake, 2.5 acres in Stone Lake, and 2.5

acres in Lily Lake. An exact estimate of milfoil acreage is not required for Clear Lake, since a whole lake Sonar treatment is the recommended action, but it appears that the entire 97 acres of the lake contains this invasive species. Estimated cost for vegetation control is $11,000 for the Renovate treatments and $14,000 for the whole lake Sonar treatment.

Vegetation surveys will be an important part of management in the four lakes. A spring Invasive Mapping Survey should be completed in mid May in order to locate areas of milfoil to be treated in Pine, Stone, and Lily Lakes. A summer Tier II survey should be completed on all four lakes in early August in order to document changes in submersed vegetation and aid in planning for the following season. This information should be included in a 2008 plan update. The estimated cost of sampling and plan update is $8,000.

# Acknowledgements

Funding for the vegetation sampling and preparation of an aquatic vegetation management plan was provided by the City of LaPorte Parks Department and the Indiana Department of Natural Resources Lake and River Enhancement Program. Aquatic Control, Inc. completed the fieldwork, data processing, and map generation. Special thanks are due to Casey Sullivan with the LaPorte Parks Department and Sue Heikes with the LaPorte Area Lake Association for their help in initiating and completing this project. Special thanks are given to Bob Robertson, Fisheries Biologists for the Indiana Department of Natural Resources-Division of Fish and Wildlife, for his assistance and review of this plan. Special thanks are also given to Gwen White and Angela Studevant, Aquatic Biologist from the Lake and River Enhancement Program (LARE) for their review and assistance on this plan. Author of this report is Nathan Long of Aquatic Control. The author would like to acknowledge the valuable input from Brian Isaacs, Brendan Hastie, Joey Leach, and Barbie Huber of Aquatic Control for their field assistance, map generation, review, and editing of this report.

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## 1.0 INTRODUCTION

In 2004, the LaPorte Area Lake Association (LALA) received LARE funding for creation of a Pine Lake Aquatic Vegetation Management Plan. This plan was updated in 2005 and 2006. In 2005 and 2006, LARE funded vegetation sampling and treatment of Eurasian watermilfoil on Pine Lake. In 2006, the City of LaPorte Parks Department requested a grant for development of a vegetation management plan for Stone, Lily, Harris, Pine and Lily Lakes. LARE made the decision to take funds intended for the Pine Lake update and vegetation control and apply them towards all five lakes. The City of LaPorte was selected to administer the grant which totaled $4,500 for planning and $20,000 for treatment.

Aquatic Control was contracted by the City of LaPorte Park and Recreation Department (CLPRD) to complete aquatic vegetation sampling in order to create a long-term integrated aquatic vegetation management plan for the five LaPorte area lakes. The study area originally included Pine Lake, Stone Lake, Lily Lake, Harris Lake and Clear Lake, which are located within the city of LaPorte in LaPorte County, Indiana (Harris Lake was removed from the study area due to a lack of navigable waters caused by a low water table). Figure 1 illustrates the study area.


Figure 1. City of LaPorte Lakes location map.

This plan was created in order to more accurately document the aquatic vegetation communities and create a feasible plan for managing nuisance vegetation within these four lakes. The plan is also a prerequisite to eligibility for the Lake and River Enhancement (LARE) program funding to control invasive exotic species. Two aquatic vegetation surveys were completed in 2007 on each of the four lakes in order to document the plant community. The surveys provided valuable information that allowed for scientifically based recommendations for aquatic plant management. Based upon the results of the surveys, Eurasian watermilfoil treatments were completed on three of the four lakes. In addition to the 2007 survey and treatment results, the following sections summarize watershed and water body characteristics, present water body uses, fisheries, problems caused by vegetation, treatment history, plant management alternatives, public involvement and education, action plan, budget, and future vegetation monitoring.

## 2.0 WATERSHED AND WATERBODY CHARACTERISTICS (Summarized from Baetis Environmental Services Inc. 2007)

All four of the study lakes are located within the city of LaPorte and are classified as Kettle Lakes. Kettles are essentially glacial melt depressions that are now lakes or wetlands. The lakes have no natural drain; an artificial outlet, a siphon, was installed, but never used, in the late 1990s to drain the lakes after an extended period of high water levels. Now, the lakes are in an extended period of low water levels. Both the high lake levels of the 1990s and the low water levels of today are the result of natural hydrologic cycles. The lakes have small watersheds relative to their sizes and volumes, and no natural outlets (Figure 2) (Baetis Environmental Services Inc. 2007). There is no data in the 2007 Diagnostic Study concerning hydraulic residence time, but based on the small watersheds and the fact that there is no physical outlet on any of the lakes, it can be assumed that there is little movement of water out of the lakes. However, it is difficult to predict the amount of water movement through the sediment.

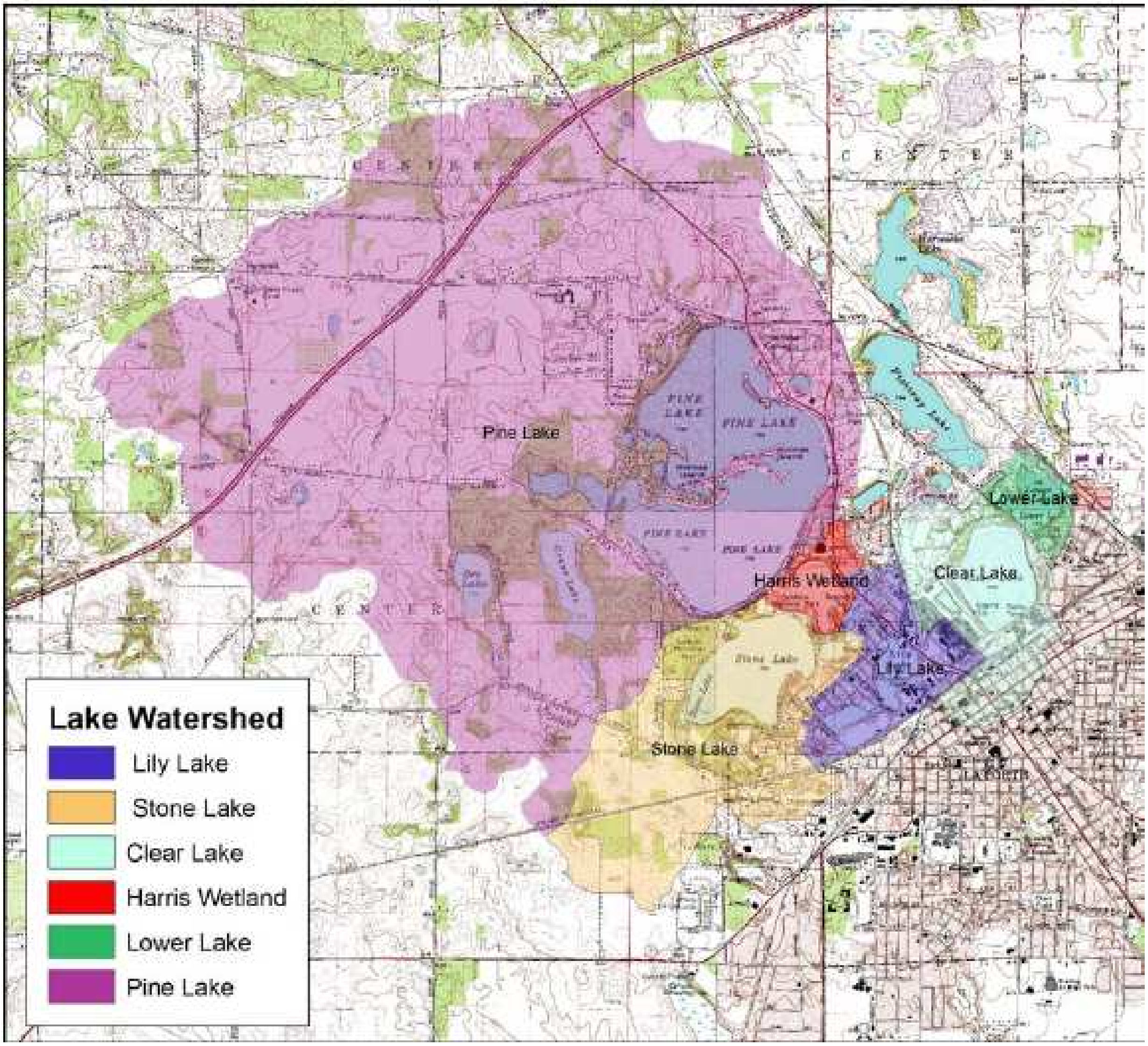


Figure 2. Watersheds of Study Lakes (Baetis Environmental Services Inc 2007).

### 2.1 Pine Lake

Pine Lake is the largest of the four lakes included in the plan. Pine Lake is approximately 543 acres with an average depth of 8.0 feet. Pine Lake's watershed encompasses an 8.82 square mile area giving it a watershed to lake area ratio of 10.4. The majority of Pine Lake's shoreline is residentially developed. Despite the development, Pine Lake is classified as a class I oligotrophic - mesotrophic Lake. The low nutrient waters are responsible for the good water clarity of the lake. Historical Secchi disk transparency depths typically ranged from 9.5-19.0 feet (Baetis Environmental Services Inc. 2007). The excellent water clarity of Pine Lake combined with a relatively large area of shallow water, promotes a rich variety of abundant aquatic vegetation to flourish around the lake (Figure 3).

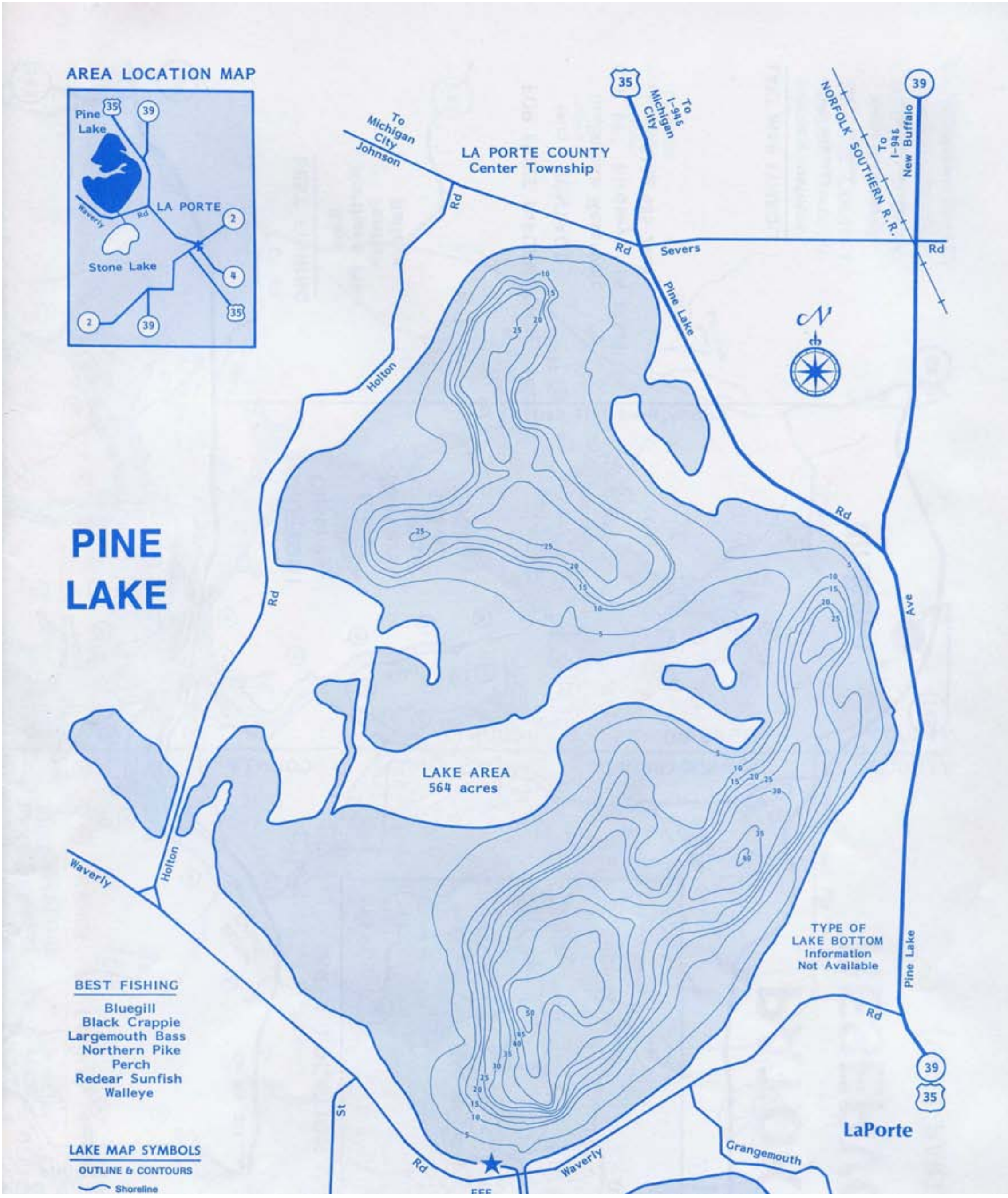


Figure 3. Pine Lake Bathymetric Map (Bright spot Maps 1999)

## 2.2 Stone Lake

Stone Lake is connected to Pine Lake via a channel along Pine's southern shore. At 149 acres, Stone Lake is the second largest lake included in this plan. Stone Lake's watershed measures 1.41 square miles giving it a watershed to lake area ration of 6.0. Stone Lake is classified as a Class I oligotrophic – mesotrophic lake. Stone Lake also exhibits excellent water clarity when compared to other Indiana Lakes. Secchi transparencies since 1975 have ranged from a low of 11.5 feet to a high of 22.0 feet (Baetis Environmental Services Inc. 2007). Clear water combined with large areas of shallow water, allows beneficial native vegetation to flourish in Stone Lake (Figure 4)

Figure 4. Stone Lake Bathymetric Map (Bright spot Maps 1999)

## 2.3 Lily Lake

Lily Lake is located east of Stone Lake. Lily Lake is indirectly connected to Stone Lake through a channel in the northeast corner of the lake. Lily Lake is the smallest lake included in this study. It measures approximately 28 acres and has maximum depth of approximately 30 feet. There is no bathymetric map available for Lily Lake, but this season's plant sampling indicated that the majority of the lake is less than 5 feet. The only deep area in the lake is located along the eastern shoreline. The Lily Lake drainage area is 0.48 square miles giving it a watershed to lake area ratio of 10.9 (Baetis Environmental Services 2007). Lily has the poorest water clarity of any of the lakes in the study with Secchi transparencies ranging from 2.0 to 8.0 feet.

## 2.4 Clear Lake

Clear is located west of the other three lakes in the study and is not directly connected to any of the other lakes. Clear Lake encompasses an area of approximately 97 acres, has an average depth of 7.8 feet and a maximum depth of approximately 12 feet. The Clear Lake drainage area is 0.65 square miles giving it a watershed to lake area ratio of 4.5 (Baetis Environmental Services 2007). Clear Lake is a shallow lake and also receives a great deal of runoff from urban areas (Figure 5). The 2007 Diagnostic Study outlines several projects that have been undertaken in an effort to reduce nutrients entering Clear Lake. These include the construction of a sediment trap, an alum dosing station, and plant harvesting for nutrient removal. Water clarity remains good in Clear Lake, but this may be due to 100% coverage of Eurasian watermilfoil.

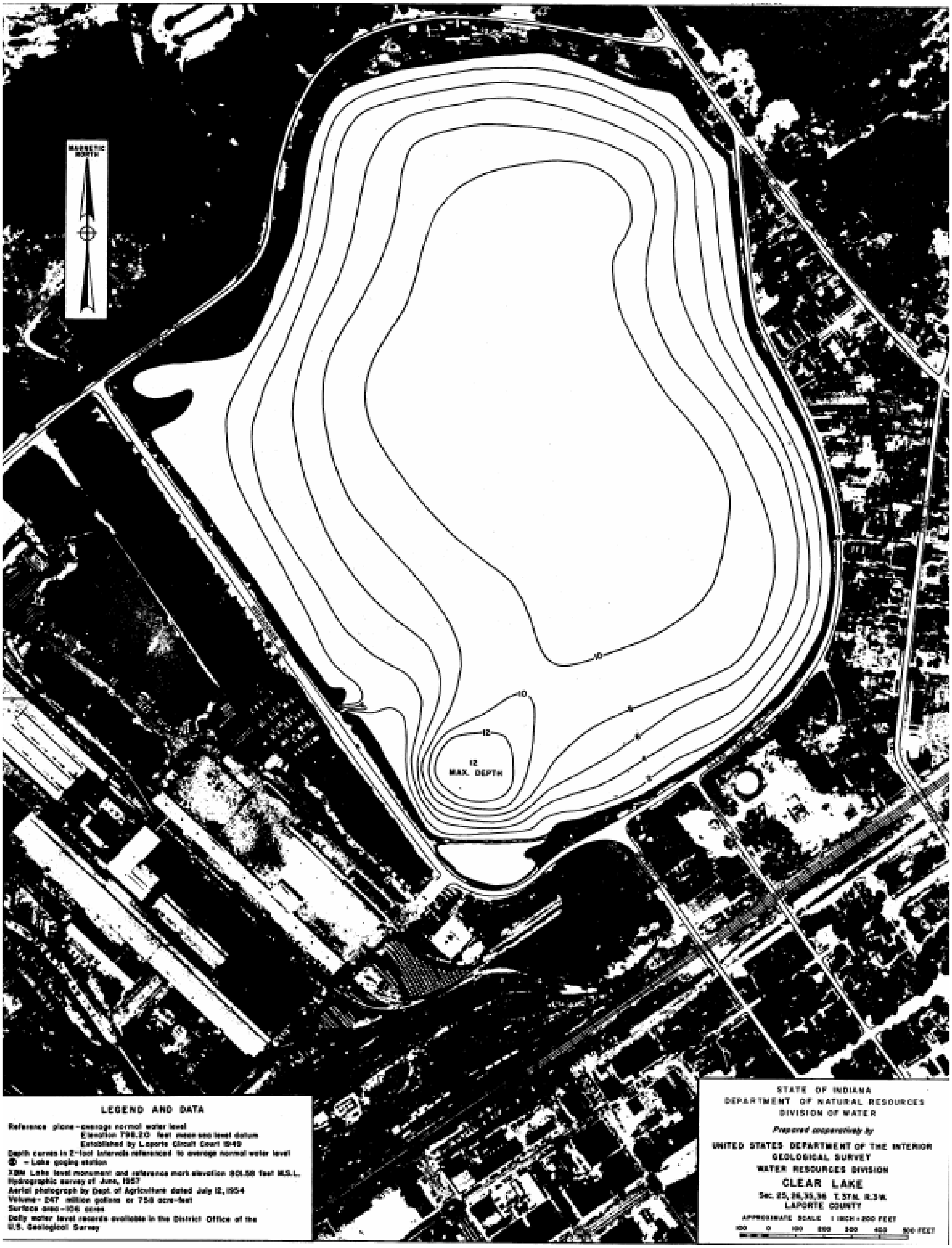


Figure 5. Bathymetric Map of Clear Lake.

## 3.0 PRESENT WATER BODY USES

There is substantial variation in the four lakes when it comes to lake use. A lake use survey was completed at a recent public meeting. The vast majority of those surveyed lived on Pine Lake. Respondents indicated that boating was the most popular activity, followed by swimming, fishing, aesthetics, and irrigation.

### 3.1 Pine Lake Water Body Uses

Pine Lake is a popular fishing, swimming, and water skiing lake. Several fee boat ramps are located around the lake and a public launch is located in Stone Lake which is connected to Pine via a channel on the south side (Figure 6). A public beach is located in the southeast corner of Pine Lake. The shoreline is highly developed, especially when compared to the other three study lakes. Two marinas and numerous boat docks dot the shoreline. The only remaining wetland area is located in the southwest corner. High speed boating is allowed in Pine Lake. The 2006 Pine Lake Aquatic Vegetation Management Plan update indicated that boating was the most popular activity, followed by swimming and fishing (Aquatic Control 2006).


Figure 6. Pine Lake usage map.

### 3.2 Stone Lake Water Body Uses

Stone Lake receives less boating pressure than Pine Lake and has far less residential development. Large areas of the shoreline are owned and managed by the City Park. The park also manages a popular public beach along the northeast shoreline (Figure 7.) A public access site is located in the southern section of the lake.


Figure 7. Stone Lake usage map.

### 3.3 Lily Lake Water Body Uses

It appears that Lily Lake receives the least amount of public use when compared to the other three lakes. This is likely due to the lack of access and abundance of shallow water. The shallow areas are home to thick stands of spatterdock that makes navigation difficult. Fishing appears to be the most popular activity on the lake and the majority of that appears to take place from shore. The only area for boat access is located along the south shore (Figure 8). There is no ramp at this location, but it is possible to launch a small boat from the road.

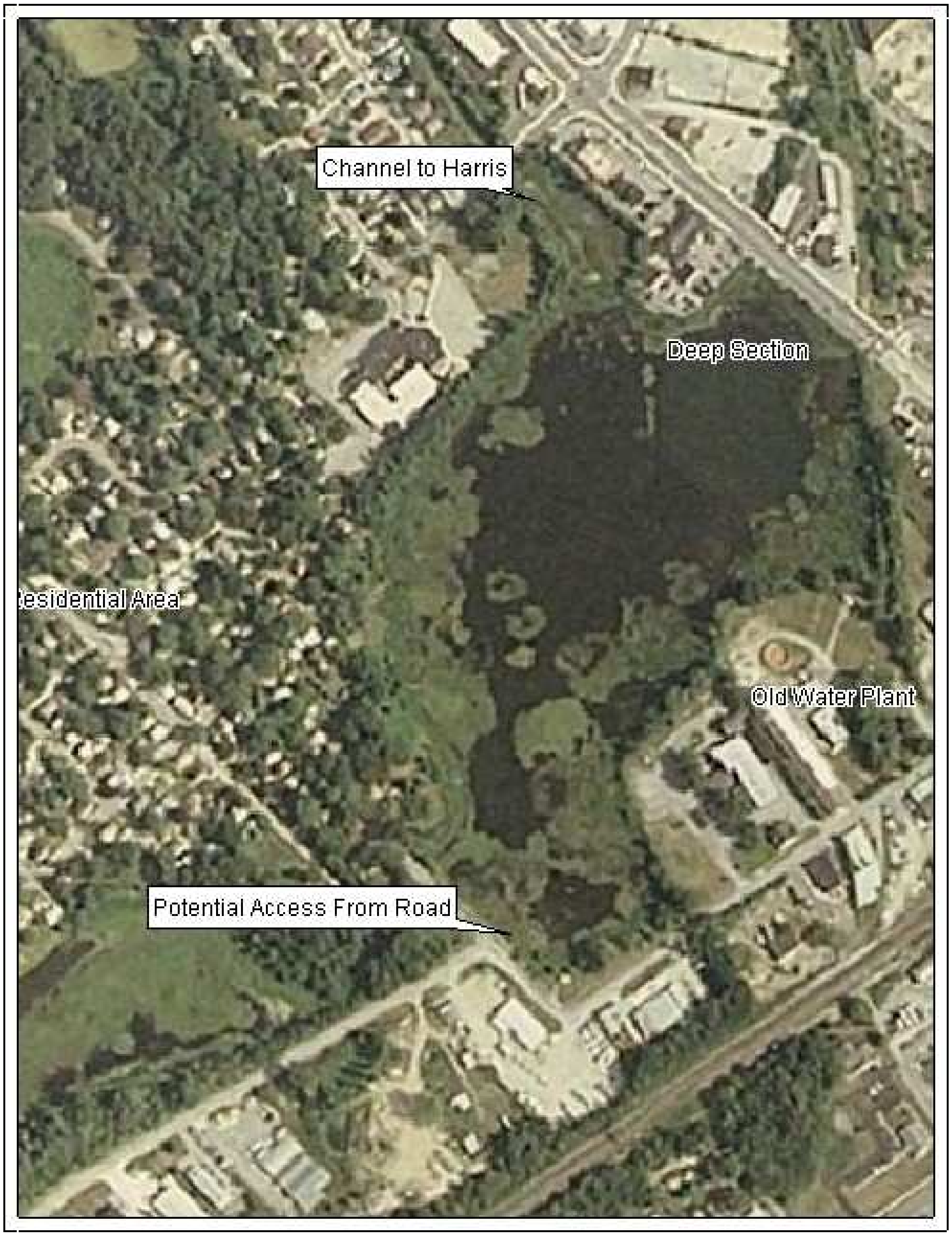

Figure 8. Lily Lake usage map.

### 3.4 Clear Lake Water Body Uses

Clear Lake is surrounded by a city street, but behind the street is city park land to the west, industrially developed land to the south, and residentially developed areas on the eastern shore. There is a public access site along the northwest side of the lake (Figure 9). No other boats were witnessed using the lake during the 2007 plant survey. Dense beds of Eurasian watermilfoil appear to be severely limiting the amount of public use of the lake. It would reason that fishing is the primary activity on Clear Lake, and it also stands to reason that if Eurasian watermilfoil was reduced that lake use would increase.

Figure 9. Clear Lake usage map.

## 4.0 FISHERIES

Fisheries management must be considered in a vegetation management plan just like aquatic vegetation is typically part of a fisheries study. Aquatic vegetation provides cover for adult and juvenile fish, supports aquatic invertebrates that are eaten by fish, and shelters small fish from predators. IDNR has completed fish surveys on Pine, Stone, and Clear Lake.

### 4.1 Pine and Stone Lake Fishery (Summarized from Aquatic Control 2005).

IDNR surveys Pine and Stone Lakes together on the grounds that they are connected by the channel under Waverly Road. Fish surveys have been completed on Pine and Stone Lakes in 1976, 1983, 1989, and 2000. The most recent survey was completed on June 19, 2000 by IDNR. The survey included 10 overnight gill net lifts, 5 overnight trap nets, and 1.25 hours of nighttime DC-electrofishing. A total of 610 fish, representing, 19 species were collected. Bluegill (*Lepomis macrochirus*) ranked first in abundance by number at 42% of the catch, followed by largemouth bass (*Micropterus salmoides*) (22%), yellow perch (*Perca flavescens*) (18%), redear sunfish (*Lepomis microlophus*)(7%), warmouth (*Lepomis gulosus*) (4%), and smallmouth bass (*Micropterus dolomieui*) (2%). The remaining species, yellow bullhead (*Ictalurus natalis*), brown bullhead (*Ictalurus nebulosus*), bowfin (*Amia calva*), brook silverside (*Labidesthes sicculus*), lake chubsucker (*Erimyzon sucetta*), grass pickerel (*Esox americanus*), black crappie (*Pomoxis nigromaculatus*), blacknose dace (*Rhinichthys atratulus*), walleye (*Stizostedion vitreum*), banded killfish (*Fundulus diaphanous*), common carp (*Cyprinus carpio*), golden shiner (*Notemigonus crysoleucas*), and Johnny darter (*Etheostoma nigrum*), all make up less than 1% of the catch (Table 1).

**Table 1. Species collected from Pine and Stone Lakes, June 19-June 29, 2000 (IDNR 2000).**

| Species Collected | Number | Percent |
|---|---|---|
| Bluegill | 254 | 41.6 |
| Largemouth Bass | 133 | 21.8 |
| Yellow Perch | 109 | 17.9 |
| Redear Sunfish | 40 | 6.6 |
| Warmouth | 23 | 3.8 |
| Smallmouth Bass | 10 | 1.6 |
| Yellow Bullhead | 6 | 1.0 |
| Brown Bullhead | 6 | 1.0 |
| Bowfin | 6 | 1.0 |
| Brook Silverside | 5 | 0.8 |
| Lake Chubsucker | 4 | 0.7 |
| Grass Pickerel | 4 | 0.7 |
| Black Crappie | 3 | 0.5 |
| Blacknose Dace | 2 | 0.3 |
| Walleye | 1 | 0.2 |
| Banded Killfish | 1 | 0.2 |
| Carp | 1 | 0.2 |
| Golden Shiner | 1 | 0.2 |
| Johnny Darter | 1 | 0.2 |

The bluegill fishery appeared to be unchanged compared to past surveys. However, largemough bass showed an increase in the abundance of quality fish. Yellow perch size and abundance did not show a significant difference compared to previous surveys, however redear sunfish were larger on average than previous surveys (IDNR 2000).

**4.2 Lily Lake Fishery**
It appears that no fish surveys have been completed on Lily Lake. According to City Park officials, common carp are abundant in Lily Lake. This species can increase turbidity due to their feeding habits. Typically, this species does not overrun a fish population unless there is a lack of sufficient predators. It is recommended that the Parks

Department have a fish survey completed on Lily Lake in order to assess the situation. IDNR may not be willing to complete a survey due to the lack of a public access site, but there are several private companies that could be contracted to do similar studies. A private contractor would have to obtain a Scientific Purposes License from IDNR in order to collect fish from the lake.

**4.3 Clear Lake Fishery (Summarized from Baetis Environmental Services 2007).**
IDNR surveyed the fishery in Clear Lake in 1980 and again in 2004. The 1980 survey found 411 fish representing 13 species. Notably, IDNR recommended chemical control of submersed aquatic vegetation in the 1980 report. The 2004 survey used similar methods and caught 518 fish representing 14 species. More than 75% of the catch by number consisted of game species accounting for 67% by weight. In 1980 bluegill was the fifth most abundant species, but in 2004, bluegill was the most numerous fish in the sample. The IDNR report indicated that bluegill growth was average for northern Indiana lakes and that the proportional stock density indicated balance between bluegill growth and abundance. Redear, black crappie, largemouth bass, and yellow perch growth were below average. IDNR reported that…"excessive submersed vegetation was undoubtedly the main factor in these poor growth rates and a contributor to occasional winterkills in Clear Lake. Despite the apparent use of a mechanical harvester, submersed vegetation was present in problem densities. Anglers often complain about the difficulty in fishing at the heavily weeded lake". Redear sunfish, increased in numbers and weight between the 1980 and 2004 surveys. This may reflect the preference of the redear for submersed vegetation, or, a relative abundance of snails, its preferred food source. Bowfin and white sucker were not found in 2004, but we do not believe this reflects an adverse change to habitats in Clear Lake (Baetis Environmental Services 2007).

**4.4 Aquatic Vegetation and Fish Management**
Aquatic vegetation is an important component in fisheries management. Aquatic vegetation provides cover for adult and juvenile fish, supports aquatic invertebrates that are eaten by fish, and shelters small fish from predators. Studies have shown that dense vegetation, especially Eurasian watermilfoil, can have negative effects on fish growth. Dr. Mike Maceina (2001) found that dense stands of Eurasian watermilfoil on Lake Guntersville proved to be detrimental to bass reproduction due to the survival of too many small bass. This led to below normal growth rates for largemouth bass and lower survival to age 1. Maceina found higher age 1 bass density in areas that contained no plants verses dense Eurasian watermilfoil stands (Maceina, 2001). Bluegill growth rates can also be affected by dense stands of Eurasian watermilfoil. It is well known by fisheries biologists that overabundant dense plant cover gives bluegill an increased ability to avoid predation and increases the survival of small young fish, which can lead to stunted growth. It is likely that the Clear Lake fishery is negatively impacted by dense stands of Eurasian watermilfoil. This theory was supported by IDNR in their 2004 survey report.

## 5.0 PROBLEM STATEMENT

As previously mentioned, aquatic vegetation is an important component of lakes in Indiana. However, as a result of many factors, this vegetation can develop to a nuisance level. Nuisance aquatic vegetation, as used in this paper, describes plant growth that negatively impacts the present uses of the lake including fishing, boating, swimming, aesthetic, and lakefront property values. The primary nuisance species within the four lakes is the exotic species Eurasian watermilfoil. Curlyleaf pondweed (*Potamogeton crispus)* is another submersed exotic species that is present at apparently low levels but has the potential to create nuisance conditions (timing of surveys was not conducive to examining the curlyleaf pondweed population).

### 5.1 Problems Caused By Eurasian Watermilfoil

Eurasian watermilfoil is an exotic invasive species of submersed vegetation that was likely introduced into our region prior to the 1940's (Figure 10). This species commonly reaches nuisance levels in Indiana Lakes. Once established, growth and physiological characteristics of milfoil enable it to form a surface canopy and develop into immense stands of weedy vegetation, outcompeting most submersed species and displacing the native plant community. These surface mats can severely impair many of the functional aspects of waterbodies such as maintenance of water quality for wildlife habitat and public health, navigation, and recreation. Furthermore, a milfoil-dominated community can greatly reduce the biodiversity of an aquatic system and negatively impact fish populations (Getsinger et. al., 1997).

Figure 10**.** Illustration of Eurasian watermilfoil (Illustration provided by Applied Biochemist).

### 5.2 Problems Caused by Curlyleaf Pondweed

Curlyleaf pondweed is an invasive exotic submersed species that was likely introduced in the early 1900's. Native to Europe and Asia, curlyleaf pondweed is now thoroughly naturalized in North America. Curlyleaf pondweed reproduces primarily vegetatively with turions and forms thick monospecific beds. The dense growth out-competes native aquatic vegetation, degrades lake water quality, and causes problems to navigation and recreation (Bolduan et al. 1994). Curlyleaf pondweed is present in many Indiana natural lakes and manmade impoundments. Curlyleaf pondweed's wavy serrated leaves give it a rather unique appearance (Figure 11).

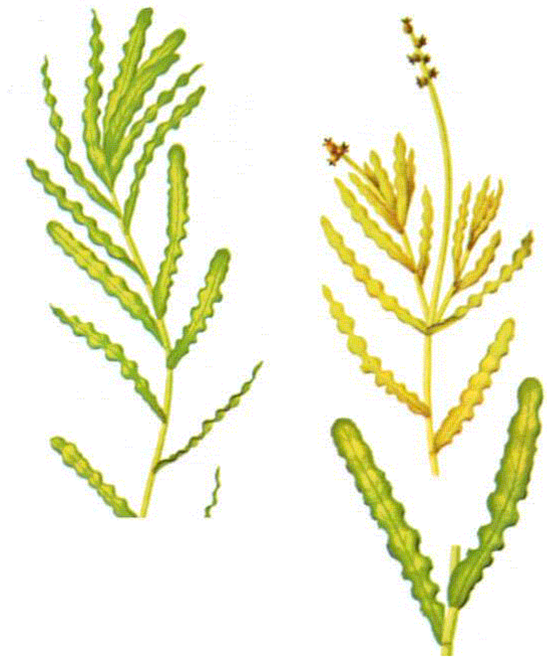

Figure 11. Illustration of curlyleaf pondweed (Illustration provided by Applied Biochemist).

## 6.0 VEGETATION MANAGEMENT GOALS

An effective aquatic vegetation management plan must include well-defined goals and objectives. Listed below are three goals formulated by LARE program staff and Division of Fish and Wildlife Biologists. The objectives, and actions used to meet the objectives, will be discussed in sections 12.0 and 13.0. One must have a better understanding of the plant community before the objectives and actions can be discussed.

*Vegetation Management Goals*

1. Develop and/or maintain a stable, diverse aquatic plant community that supports a good balance of predator and prey fish and wildlife species, good water quality, and is resistant to minor habitat disturbances and invasive species
2. Direct efforts to preventing and/or controlling the negative impacts of aquatic invasive species.
3. Provide reasonable public recreational access while minimizing the negative impacts on plant and fish and wildlife resources.

## 7.0 VEGETATION MANAGEMENT HISTORY

In order to craft an effective plant management plan it is important to review past aquatic vegetation controls. This review can help prevent past unsuccessful management mistakes from being repeated or may give the manager insight into successful techniques.

### 7.1 Pine Lake

Pine Lake is the largest of the four lakes and has recieved the most aggressive plant management actions of the four lakes. These actions have been primarily sponsored the LaPorte Area Lake Association (LALA). The Pine Lake Aquatic Vegetation Management Plan and updates have detailed these actions over the last several seasons. Table 2 summarizes the plant management history of Pine Lake from 2003-2007.

**Table 2. Pine Lake plant management history 2003-2007.**

| Year | Species Targeted | Herbicide Applied | Funding Source | Acres Treated |
|---|---|---|---|---|
| 2003 | E.milfoil, naiad, coontail, curlyleaf pw | Reward & Nautique | LALA | 20.0 |
| 2004 | E. milfoil, naiad, coontail, curlyleaf pw | Reward & Nautique | LALA | 20.0 |
| 2005 | E.milfoil, naiad, coontail, curlyleaf pw | Reward & Nautique | LALA | 16.0 |
| 2005 | E. milfoil | Renovate | LARE & LALA | 8.0 |
| 2006 | E.milfoil, naiad, coontail, curlyleaf pw | Aquathol K, Reward, & Nautique | LALA | 16.0 |
| 2006 | E. milfoil | Renovate | LARE & LALA | 15.0 |
| 2007 | E.milfoil, naiad, coontail, curlyleaf pw | Reward & Nautique | LALA | 15.7 |
| 2007 | E. milfoil | Renovate | LARE & LaPorte Parks | 23.8 |

In 2007, the LaPorte Area Lake Association funded two shoreline treatments on Pine Lake. These treatments were designed to reduce nuisance conditions in near-shore areas. Treatments were completed on May 21 and July 9 with a combination of Reward (active ingredient: diquat) and Nautique (active ingredient: copper). Aquatic Control treated a total of 15.7 acres with this combination of contact herbicides during the 2007 season (Figure 12).

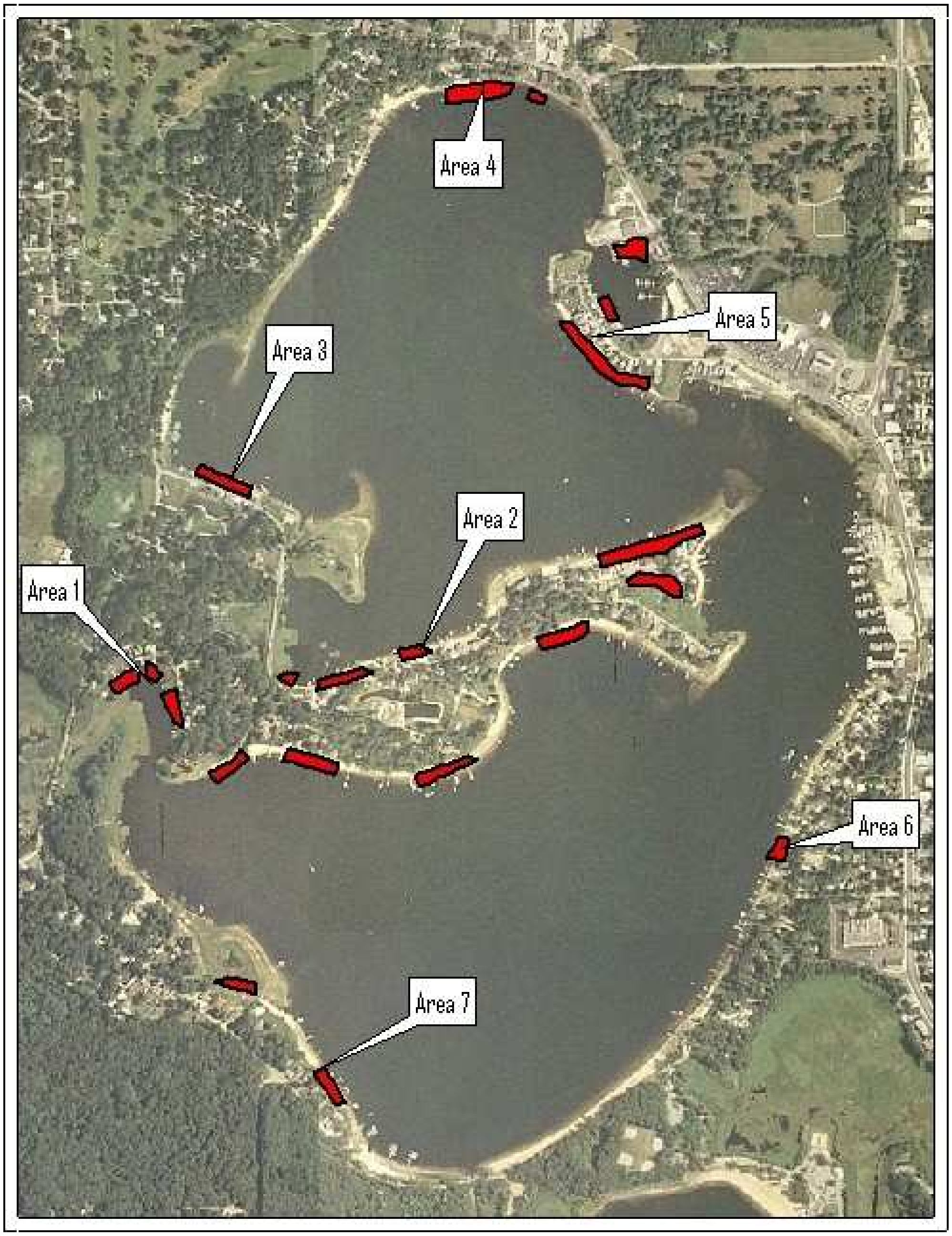


Figure 12. Pine Lake, 2007 contact herbicide treatment areas.

LARE and the LaPorte Parks Department funded treatment of Eurasian watermilfoil on August 23, 2007 (treatment was completed later in the season than desired due to a delayed selection of a LARE contractor). A total of 23.8 acres was treated with Renovate 3 liquid herbicide and Renovate OTF granular herbicide (Figure 13). Treatment areas were mapped out during the Invasive Species Survey which was conducted two weeks prior. Areas were downloaded onto GPS units which were used in the application in order to insure accuracy in the application. Treatment areas were inspected three weeks after the treatment and it was determined that Eurasian watermilfoil was controlled. In the shallow treatment areas Eurasian watermilfoil had already been replaced by dense beds of native vegetation, primarily eel grass (some residents understandably considered this to be an unsuccessful treatment due to the lack of relief from nuisance conditions).

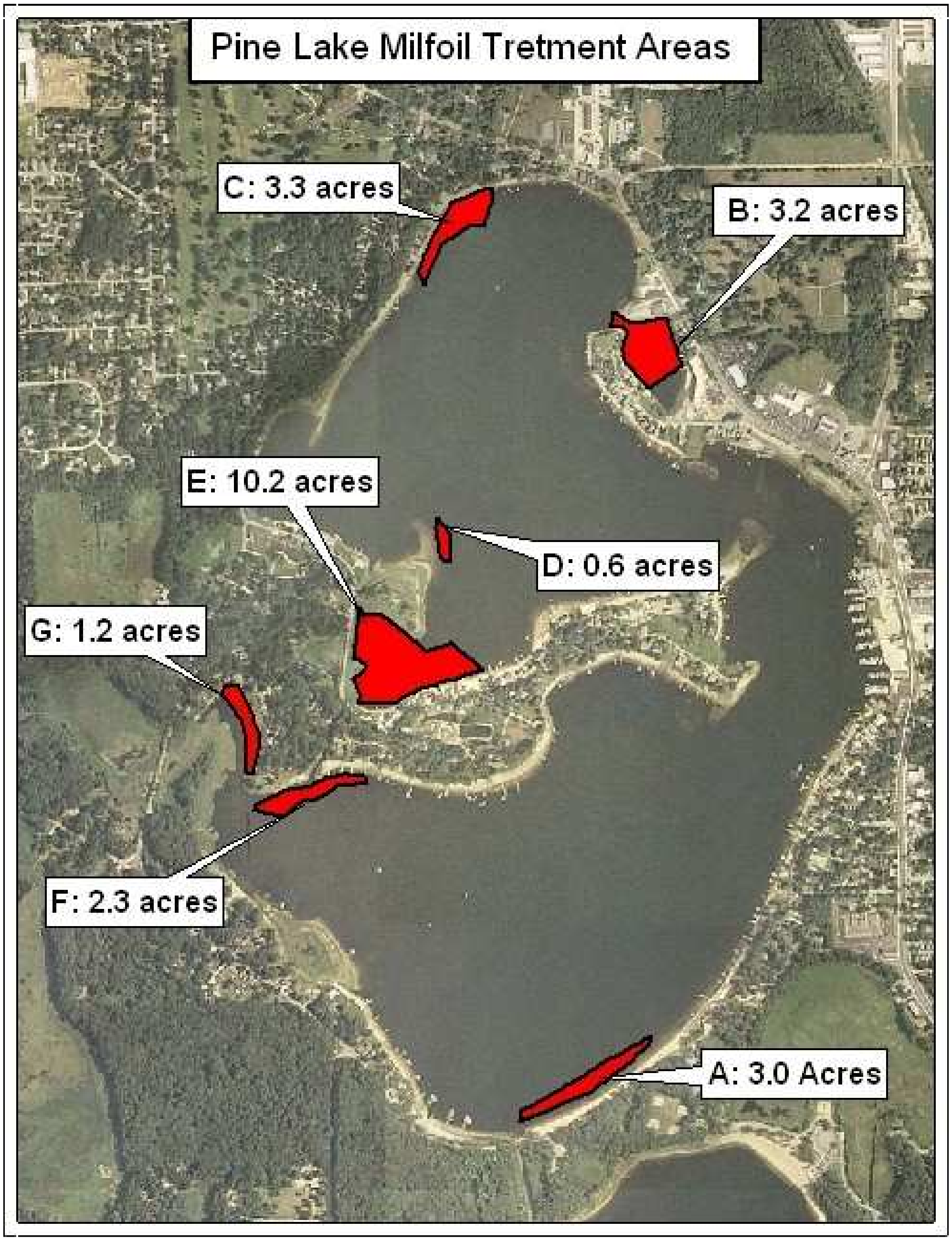


Figure 13. Pine Lake, Eurasian watermilfoil treatment areas, August 23, 2007.

### 7.2 Stone Lake

Very little vegetation management has been completed on Stone Lake due to the lack of development and the lack of substantial levels of nuisance invasive species. However, in 2005 and 2007, residents along the western shoreline contracted Aquatic Control Inc. to complete treatments to a 1.0 acre area along their docks (Figure 14). Treatments were completed using a combination of Reward and Nautique herbicides.


Figure 14. Stone Lake contact herbicide treatment area.

LARE and the LaPorte Parks department funded treatment of 0.5 acres of Eurasian watermilfoil on Stone Lake (Figure 15). This area was located during Invasive Species Mapping which was completed two weeks prior to the application. Treatment was completed on August 23 with Renovate OTF granular herbicide. A GPS unit was used in the application in order to insure accuracy.

Figure 15. Stone Lake, Eurasian watermilfoil treatment area, August 23, 2007.

**7.3 Lily Lake**

There are no records of vegetation controls on Lily Lake prior to 2007. LARE and LaPorte Parks funded treatment of 2.7 acres of milfoil in 2007 (Figure 16). Areas for treatment were determined during the Invasive Species Mapping survey and on August 23 Renovate 3 herbicide was applied to these areas.


Figure 16. Lily Lake, Eurasian watermilfoil treatment areas, August 23, 2007.

## 7.4 Clear Lake

Clear Lake is by far the most impaired lake of the four lakes in this study. Harvesting of vegetation is the only control that has been documented on Clear Lake (there were areas that appeared to be treated with herbicides, but there was no record of permits being issued). The City has been operating an aquatic plant harvester on the lake for over a decade (Figure 17), based upon the recommendations of a prior LARE feasibility study (Harza 1990 cited in Baetis Environmental Services 2007). Those recommendations were based in part upon the potential long-term nutrient removal benefits of harvesting. Records have unfortunately not been kept allowing for estimation of the nutrient removal using the harvester. Despite use of this equipment for over a decade, the extent and abundance of Eurasian watermilfoil appears to be the same, or possibly greater than, levels present prior to the harvesting program. The current program may be removing phosphorus from Clear Lake and benefiting its water quality, but the machine produces fragments of Eurasian watermilfoil that can regenerate. This may be the reason watermilfoil is so evenly distributed across Clear Lake (Baetis Environmental Services 2007).


Figure 17. Clear Lake, photo of harvester, August 8, 2007.

No LARE funded herbicide treatments were completed on Clear Lake in 2007. The decision not to treat was made by Aquatic Control plant managers and LaPorte Park personnel. Due to the extent of vegetation and the fact that the treatment would have to be completed in late summer, it was feared that a large-scale treatment could cause dissolved oxygen declines resulting in a potential fish kill. In addition, there were not enough funds to treat all areas of milfoil in Clear Lake and the treatment results would be short-lived due to milfoil's ability to quickly re-establish into controlled areas.

## 8.0 AQUATIC PLANT COMMUNITY CHARACTERIZATION

Aquatic vegetation sampling must be completed in order to create an effective aquatic vegetation management plan. Sampling provides valuable data that allows managers to accomplish several tasks: locate areas of nuisance and beneficial vegetation; monitor changes in density and abundance of native and exotic species; monitor and react to changes in the overall plant community; monitor the effectiveness of management techniques; and compare the plant communities to other populations. In 2007, LARE and the LaPorte Parks Department funded Invasive Species Mapping Surveys along with Tier II surveys on all four lakes. These surveys were not designed to inventory all species. Surveys primarily focused on submersed invasive and native macrophyte populations. In addition, several historical surveys have also been completed. In 2006, Baetis Environmental Services completed a more detailed inventory of the lakes as part of the 2007 Diagnostic Study.

## 8.1 Methods

### *8.1.1 Invasive Mapping Survey*

The purpose of the invasive mapping survey is to locate and record areas of invasive species. The maps created from this survey can then be used by the plant manager in order to effectively control the areas of invasive species. At this time, there is no standard IDNR protocol for the Invasive Mapping Survey. Despite the lack of protocol, most plant managers have developed accurate techniques for this method of surveying since this technique is needed in order to perform effective and accurate vegetation controls.

Invasive species mapping is completed by using a motorized boat. Prior to mapping, a Secchi disk reading is taken and the maximum depth of vegetation growth is determined. This type of survey requires one driver and at least one surveyor. The surveyor positions themself on the bow of the boat with a map and GPS device. The surveyor motions the driver navigational directions and the boat is driven in a zigzag pattern around the littoral zone of the lake. Once an invasive species is observed the surveyor records the position on the GPS device. The area where the invasive species are observed is then surveyed in a tighter zigzag fashion until the edges of the invasive plant bed can be determined. Waypoints are taken around the edge of the invasive beds and notes are recorded on the map concerning density of vegetation within the bed (if plants are not visible within littoral areas then rake tosses should be used in place of visual observation). This information is taken back to the office and downloaded into a mapping program that contains an accurate aerial shot of the lake. Areas where invasive species were recorded are then mapped and measured using the mapping program. This survey method serves to meet the following objectives:

1. to provide a distribution map of invasive species within a water body
2. to document gross changes in the extent of invasive species within a water body

### *8.1.2 Tier II Methods*

The Tier II survey helps meet the following objectives:

1. to document the distribution and abundance of submersed and floating-leaved aquatic vegetation
2. to compare present distribution and abundance with past distribution and abundance within select areas

The number and depth of sampling sites are selected based upon lake size and classification (Table 3). Once a site was reached the boat was slowed to a stop and the coordinates were recorded on a hand-held GPS unit and later downloaded into a mapping program. A depth measurement was taken by dropping a two-headed standard sampling rake that was attached to a rope marked off in 1-foot increments (Figure 18). An additional ten feet of rope was released and the boat was reversed at minimum operating speed for a distance of ten feet. Once the rake is retrieved the overall plant abundance on the rake is scored with either a 0 (no plants retrieved), 1 (1-20% of rake teeth filled), 3 (21-99% of rake teeth filled), or 5 (100% of rake teeth filled) and then individual species are placed back on the rake and scored separately.

**Table 3. Tier II sampling design for Pine, Stone, Clear, and Lily Lakes.**

| Lake | Size | Class | # of Sample Points | Max Depth | Protocol sample size and depth contour recommendation* |
|---|---|---|---|---|---|
| **Pine** | 564 | Oligo | 90 | 25 | 22, 21, 19, 18, 10 |
| **Stone** | 125 | Meso | 50 | 20 | 14, 14, 12, 10 |
| **Lily** | 16 | Oligo | 30 | 20 | 10, 10, 7, 3 |
| **Clear** | 106 | Oligo | 50 | 15 | 23,17,10 |

* Number of samples to be taken from each 0-5 ft depth contour. First number listed is for 0-5ft, second number 5-10 ft, third number 10-15 ft, fourth number 15-20 feet and fifth number 20-25 ft.

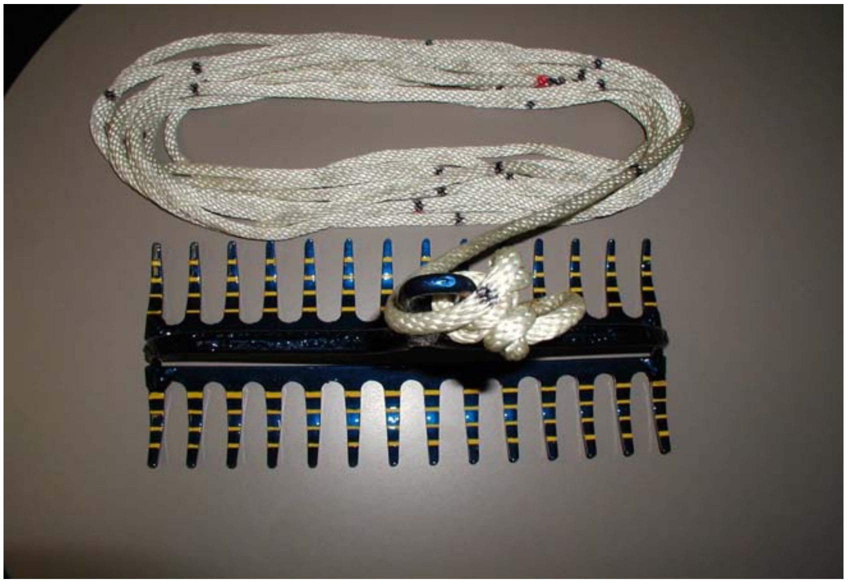

Figure 18. Sampling Rake

The data is used to calculate different lake characteristics and community and species metrics. The different characteristics and metrics calculated from the Tier II method are defined below:

Littoral depth: Maximum depth that aquatic vegetation is present.
Total sites: Total number of sites sampled.
Secchi depth: Measurement of the transparency of water.

<u>Species richness</u>: count of all submersed plant species collected.
<u>Native species richness</u>: count of all native submersed plant species collected.
<u>Maximum number of species per site</u>: highest number of species collected at any site.
<u>Mean number of species per site</u>: The average number of all species collected per littoral site.
<u>Mean number of native species per site</u>: The average number of native species per site.
<u>Species diversity index</u>: This is a modified Simpson's diversity index which is a measure that provides a means of comparing plant community structure and stability over time.
<u>Frequency of occurrence</u>: Measurement of the proportion of sites where each species is present.
<u>Relative frequency of occurrence</u>: Measures how the plants occur throughout the lake in relation to each other.
<u>Dominance index</u>: Combines the frequency of occurrence and relative density into a dominance value that characterizes how dominant a species is within the macrophyte community (IDNR 2007).

## 8.2 Sampling Results

### *8.2.1 Pine Lake*

#### *8.2.1.1 Historical Surveys*

Pine Lake's aquatic macrophyte population has been surveyed on several occasions by INDR, consulting firms, universities, and plant managers. Historical IDNR surveys and LARE funded surveys are outlined in the Pine Lake Aquatic Vegetation Management Plan and updates. Generally, these surveys documented a very diverse plant population along with rather small populations of invasive species.

Baetis Environmental Services (2007) completed one of the most recent surveys of Pine Lake. In 2006, they documented 39 different species. Eurasian watermilfoil was the only submersed non-native species collected and it was found at only 15% of sites sampled. This survey also documented the presence of the state-endangered *Myriophyllum tenellum* (slender milfoil). Floating and emergent beds of aquatic plants were uncommon on the lake due to shoreline development. Isolated stands of the non-native common reed (*Phragmites communis*) and purple loosestrife (*Lythrim salicaria*) were also observed.

#### *8.2.1.2 2007 Sampling Results*

On August 8, 2007 Aquatic Control completed Invasive Species Mapping Survey. A Tier II survey was completed on August 23, 2007. It was the intention of LARE to complete these surveys earlier in the season, but there was a delay in the contractor selection process. Twenty-nine species were either collected or observed during the survey. Table 4 is a list of the common and scientific names of species documented during those surveys.

**Table 4. Species list for Pine Lake**

| Scientific Name | Common Name |
|---|---|
| *Bidens beckii* | bur marigold |
| *Brasenia schreberi* | watershield |
| *Ceratophyllum demersum* | common coontail |
| *Chara spp.* | chara |
| *Elodea canadensis* | American elodea |
| *Lemna trisulca* | star duckweed |
| *Lythrum salicaria* | purple loosestrife |
| *Myriophyllum heterophyllum* | variable milfoil |
| *Myriophyllum sibiricum* | northern watermilfoil |
| *Myriophyllum spicatum* | Eurasian Watermilfoil |
| *Najas flexillis* | slender naiad |
| *Najas guadalupensis* | southern naiad |
| *Nuphar advena* | spatterdock |
| *Nymphaea odorata* | white water lily |
| *Phragmites australis* | common reed |
| *Potamogeton amplifoilus* | largeleaf pondweed |
| *Potamogeton gramineus* | variable pondweed |
| *Potamogeton illinoensis* | Illinois pondweed |
| *Potamogeton pectinatus* | sago pondweed |
| *Potamogeton praelongus* | whitestemmed pondweed |
| *Potamogeton richardsonii* | Richardson's pondweed |
| *Potamogeton robbinsii* | Robbin's pondweed |
| *Potamogeton zosteriformis* | flatstemmed pondweed |
| *Polygonum spp.* | smart weed |
| *Sagittaria graminea* | grassy arrowhead |
| *Ranunculus longiroostris* | white water buttercup |
| *Typha latifolia* | common cattail |
| *Vallisneria americana* | eel grass |
| *Zosterella dubia* | waterstar grass |

The Invasive Species Mapping Survey was completed on August 8, 2007. Invasive species mapping located 25.9 acres of Eurasian watermilfoil of which 14.1 acres was considered dense (greater than 50% overall abundance) and 11.8 acres of milfoil accounted for less than 50% of vegetation in the mapped areas (Figure 19). No curlyleaf pondweed was detected.

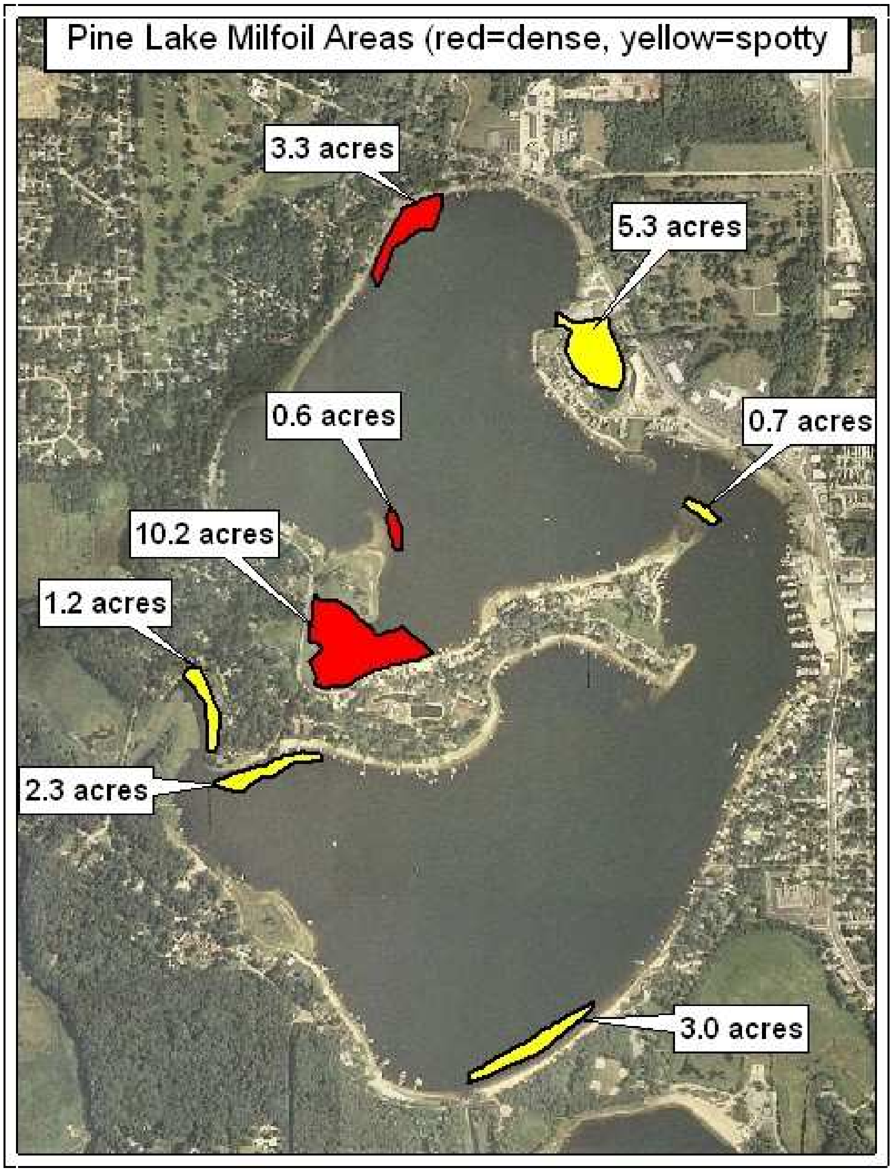


Figure 19. Pine Lake Eurasian watermilfoil location, August 8, 2007

A Tier II survey was completed on August 23, 2007 (Table 5). A Secchi depth reading was taken prior to the survey and found to be 16.0 feet. The same 90 points that were sampled in the 2006 survey were again sampled in 2007. Plants were collected to a maximum depth of 20 feet and were present at 62 of the 90 sample sites (no plants were collected over 20 feet, but 15 sites over 20 feet were sampled, so plants actually occurred at 82.6% of littoral sites). A total of 20 species were collected of which 19 of the species were native. The maximum number of species per site was 8 and the mean number of species collected per site was 2.49. The mean number of native species collected per site was 2.27. The species diversity index was 0.91 and the native species diversity index was 0.90. It is recommended that sample sites be adjusted next season in order to only include sites in water less than 20 feet deep.

**Table 5. Occurrence and abundance of submersed aquatic plants in Pine Lake, August 23, 2007.**

**Occurrence and abundance of submersed aquatic plants in Pine Lake**

| | | | | | |
|---|---|---|---|---|---|
| County: | LaPorte | Sites with plants: | 62 | Mean species/site: | 2.49 |
| Date: | 8/23/2007 | Sites with native plants: | 62 | Standard error (ms/s): | 0.2360962 |
| Secchi (ft): | 16 | Number of species: | 20 | Mean native species/site: | 2.27 |
| Maximum plant depth (ft): | 20 | Number of native species: | 19 | Standard error (mns/s): | 0.220543 |
| Trophic status | Mesotrophic | Maximum species/site: | 8 | Species diversity: | 0.91 |
| Total sites: | 90 | | | Native species diversity: | 0.90 |

| All depths (0 to 20 ft)<br>Species | Frequency of Occurrence | Rake score frequency per species<br>0 | 1 | 3 | 5 | Plant Dominance |
|---|---|---|---|---|---|---|
| eel grass | 44.4 | 55.6 | 2.2 | 7.8 | 34.4 | 27.1 |
| common coontail | 30.0 | 70.0 | 4.4 | 4.4 | 21.1 | 17.6 |
| Eurasian watermilfoil | 22.2 | 77.8 | 1.1 | 7.8 | 13.3 | 10.2 |
| variable pondweed | 22.2 | 77.8 | 0.0 | 1.1 | 20.0 | 14.2 |
| northern watermilfoil | 21.1 | 78.9 | 1.1 | 2.2 | 17.8 | 8.2 |
| whitestemmed pondweed | 21.1 | 78.9 | 0.0 | 2.2 | 18.9 | 10.9 |
| slender naiad | 18.9 | 81.1 | 0.0 | 2.2 | 16.7 | 6.0 |
| American elodea | 18.9 | 81.1 | 0.0 | 1.1 | 17.8 | 6.0 |
| flatstemmed pondweed | 12.2 | 87.8 | 1.1 | 1.1 | 10.0 | 6.0 |
| Robbin's pondweed | 10.0 | 90.0 | 0.0 | 0.0 | 10.0 | 3.3 |
| water stargrass | 5.6 | 94.4 | 0.0 | 1.1 | 4.4 | 2.0 |
| stiff water crowfoot | 4.4 | 95.6 | 0.0 | 0.0 | 4.4 | 0.9 |
| bur marigold | 3.3 | 96.7 | 0.0 | 0.0 | 3.3 | 0.7 |
| Illinois pondweed | 3.3 | 96.7 | 0.0 | 0.0 | 3.3 | 1.6 |
| large leaf pondweed | 3.3 | 96.7 | 0.0 | 0.0 | 3.3 | 2.0 |
| sago pondweed | 2.2 | 97.8 | 0.0 | 1.1 | 1.1 | 0.4 |
| variable milfoil | 2.2 | 97.8 | 0.0 | 0.0 | 2.2 | 1.3 |
| Chara | 1.1 | 98.9 | 0.0 | 1.1 | 0.0 | 0.2 |
| Richardson's pondweed | 1.1 | 98.9 | 0.0 | 0.0 | 1.1 | 0.2 |
| southern naiad | 1.1 | 98.9 | 0.0 | 0.0 | 1.1 | 0.2 |

| All depths (0 to 5 ft)<br>Species | Frequency of Occurrence | Rake score frequency per species<br>0 | 1 | 3 | 5 | Plant Dominance |
|---|---|---|---|---|---|---|
| American elodea | 47.1 | 52.9 | 0.0 | 5.9 | 41.2 | 16.5 |
| eel grass | 41.2 | 58.8 | 0.0 | 17.6 | 23.5 | 15.3 |
| Eurasian watermilfoil | 35.3 | 64.7 | 5.9 | 17.6 | 11.8 | 11.8 |
| slender naiad | 35.3 | 64.7 | 0.0 | 11.8 | 23.5 | 11.8 |
| variable pondweed | 35.3 | 64.7 | 0.0 | 5.9 | 23.5 | 18.8 |
| common coontail | 11.8 | 88.2 | 5.9 | 0.0 | 5.9 | 2.4 |
| flatstemmed pondweed | 11.8 | 88.2 | 0.0 | 0.0 | 11.8 | 11.8 |
| northern milfoil | 11.8 | 88.2 | 0.0 | 11.8 | 0.0 | 2.4 |
| Robbin's pondweed | 11.8 | 88.2 | 0.0 | 0.0 | 11.8 | 7.1 |
| whitestemmed pondweed | 11.8 | 88.2 | 0.0 | 5.9 | 5.9 | 2.4 |
| water stargrass | 11.8 | 88.2 | 0.0 | 5.9 | 5.9 | 4.7 |
| sago pondweed | 5.9 | 94.1 | 0.0 | 5.9 | 0.0 | 1.2 |
| southern naiad | 5.9 | 94.1 | 0.0 | 0.0 | 5.9 | 1.2 |
| variable milfoil | 5.9 | 94.1 | 0.0 | 0.0 | 5.9 | 5.9 |

| All depths (5 to 10 ft)<br>Species | Frequency of Occurrence | Rake score frequency per species<br>0 | 1 | 3 | 5 | Plant Dominance |
|---|---|---|---|---|---|---|
| eel grass | 77.4 | 22.6 | 0.0 | 6.5 | 71.0 | 51.6 |
| whitestemmed pondweed | 41.9 | 58.1 | 0.0 | 3.2 | 38.7 | 25.2 |
| common coontail | 38.7 | 61.3 | 0.0 | 3.2 | 35.5 | 25.8 |
| variable pondweed | 38.7 | 61.3 | 0.0 | 0.0 | 38.7 | 27.1 |
| northern milfoil | 35.5 | 64.5 | 0.0 | 0.0 | 35.5 | 14.8 |
| slender naiad | 35.5 | 64.5 | 0.0 | 0.0 | 35.5 | 11.0 |
| Eurasian watermilfoil | 32.3 | 67.7 | 0.0 | 6.5 | 25.8 | 18.1 |
| American elodea | 25.8 | 74.2 | 0.0 | 0.0 | 25.8 | 7.7 |
| Robbin's pondweed | 22.6 | 77.4 | 0.0 | 0.0 | 22.6 | 5.8 |
| flatstemmed pondweed | 16.1 | 83.9 | 0.0 | 3.2 | 12.9 | 5.8 |
| stiff water crowfoot | 12.9 | 87.1 | 0.0 | 0.0 | 12.9 | 2.6 |
| bur marigold | 9.7 | 90.3 | 0.0 | 0.0 | 9.7 | 1.9 |
| Illinois pondweed | 9.7 | 90.3 | 0.0 | 0.0 | 9.7 | 4.5 |
| large leaf pondweed | 6.5 | 93.5 | 0.0 | 0.0 | 6.5 | 3.9 |
| water stargrass | 6.5 | 93.5 | 0.0 | 0.0 | 6.5 | 1.3 |
| Chara | 3.2 | 96.8 | 0.0 | 3.2 | 0.0 | 0.6 |
| Richardson's pondweed | 3.2 | 96.8 | 0.0 | 0.0 | 3.2 | 0.6 |
| sago pondweed | 3.2 | 96.8 | 0.0 | 0.0 | 3.2 | 0.6 |
| variable milfoil | 3.2 | 96.8 | 0.0 | 0.0 | 3.2 | 0.6 |

| All depths (10 to 15 ft)<br>Species | Frequency of Occurrence | Rake score frequency per species<br>0 | 1 | 3 | 5 | Plant Dominance |
|---|---|---|---|---|---|---|
| common coontail | 70.0 | 30.0 | 0.0 | 20.0 | 50.0 | 42.0 |
| eel grass | 70.0 | 30.0 | 0.0 | 20.0 | 50.0 | 54.0 |
| northern milfoil | 50.0 | 50.0 | 0.0 | 0.0 | 50.0 | 22.0 |
| Eurasian watermilfoil | 40.0 | 60.0 | 0.0 | 20.0 | 20.0 | 16.0 |
| whitestemmed pondweed | 30.0 | 70.0 | 0.0 | 0.0 | 30.0 | 14.0 |
| flatstemmed pondweed | 20.0 | 80.0 | 0.0 | 0.0 | 20.0 | 4.0 |
| variable pondweed | 20.0 | 80.0 | 0.0 | 0.0 | 20.0 | 12.0 |
| American elodea | 10.0 | 90.0 | 0.0 | 0.0 | 10.0 | 2.0 |
| large leaf pondweed | 10.0 | 90.0 | 0.0 | 0.0 | 10.0 | 6.0 |
| water stargrass | 10.0 | 90.0 | 0.0 | 0.0 | 10.0 | 6.0 |

| All depths (15 to 20 ft)<br>Species | Frequency of Occurrence | Rake score frequency per species<br>0 | 1 | 3 | 5 | Plant Dominance |
|---|---|---|---|---|---|---|
| common coontail | 40.0 | 60.0 | 20.0 | 6.7 | 13.3 | 21.3 |
| eel grass | 13.3 | 86.7 | 13.3 | 0.0 | 0.0 | 2.7 |
| flatstemmed pondweed | 13.3 | 86.7 | 6.7 | 0.0 | 6.7 | 8 |
| northern milfoil | 6.7 | 93.3 | 6.7 | 0.0 | 0.0 | 1.3 |
| whitestemmed pondweed | 6.7 | 93.3 | 0.0 | 0.0 | 6.7 | 1.3 |

species observed but not sampled; star duckweed,spatterdock, watershield,white water lily, grassy arrowhead common reed, smart weed, common cattail, & purple loosestrife.

Eel grass was collected at the highest percentage of sample sites (44.4%) and had the highest dominance index (27.1). Location and density of eel grass is illustrated in Figure 20. Common coontail ranked second in frequency (30.0%) and dominance (17.6). Eurasian watermilfoil was the only non-native species collected and it was tied for third in frequency (14.4%) and ranked fifth in dominance (10.2) (Figure 21). Variable pondweed, northern watermilfoil, whitestem pondweed, slender naiad, American elodea, flatstem pondweed, and Robbin's pondweed all occurred at 10% or more of sample sites. Whitestem pondweed is considered state threatened. It occurred at 21.1% of sample sites and its location and density is illustrated in Figure 22. Robbin's pondweed is considered to be rare in Indiana, but it occurred at 10.0% of sample sites in Pine Lake (Figure 23). Bur marigold, a state threatened species, was collected at only two sites (Figure 24).

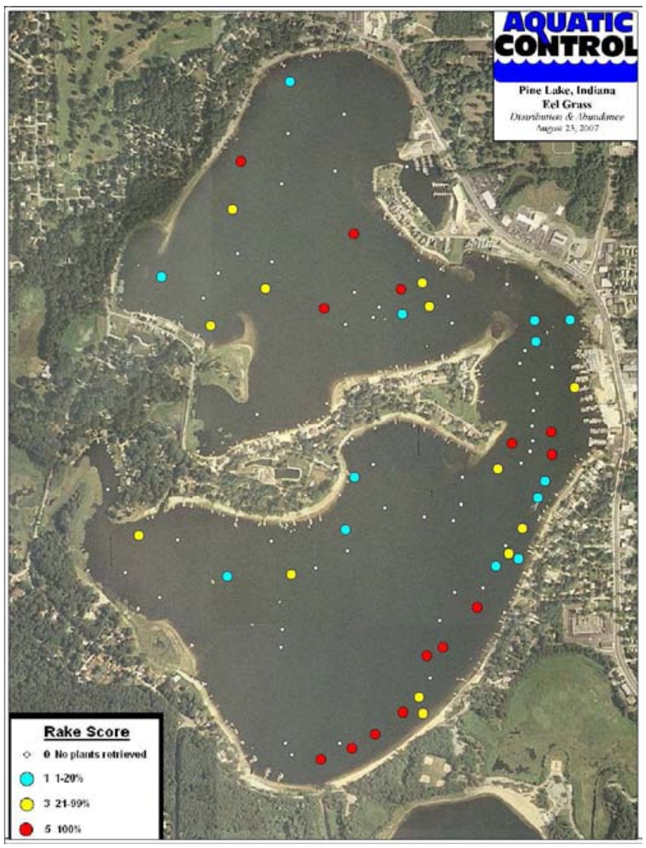

Figure 20. Pine Lake, eel grass distribution and abundance, August 23, 2007.

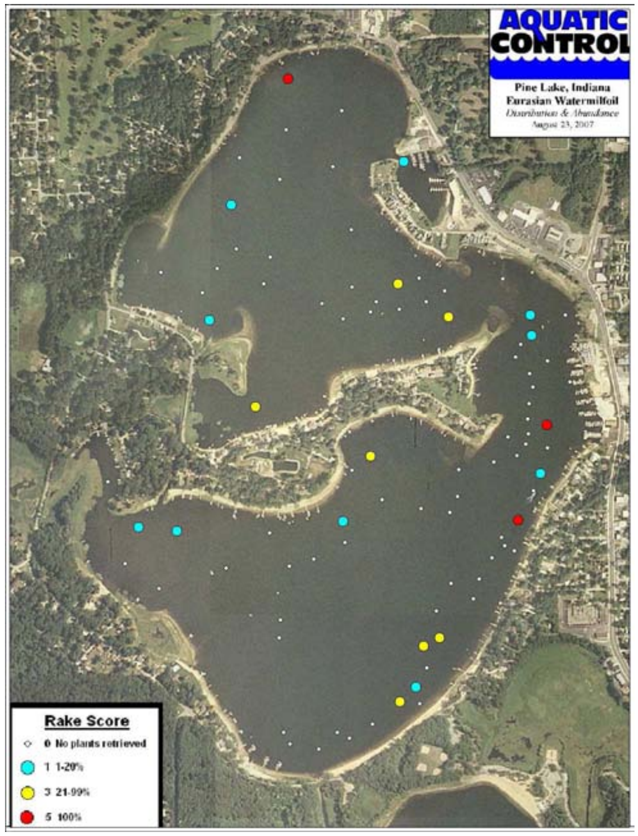


Figure 21. Pine Lake, Eurasian watermilfoil distribution and abundance, August 23, 2007.

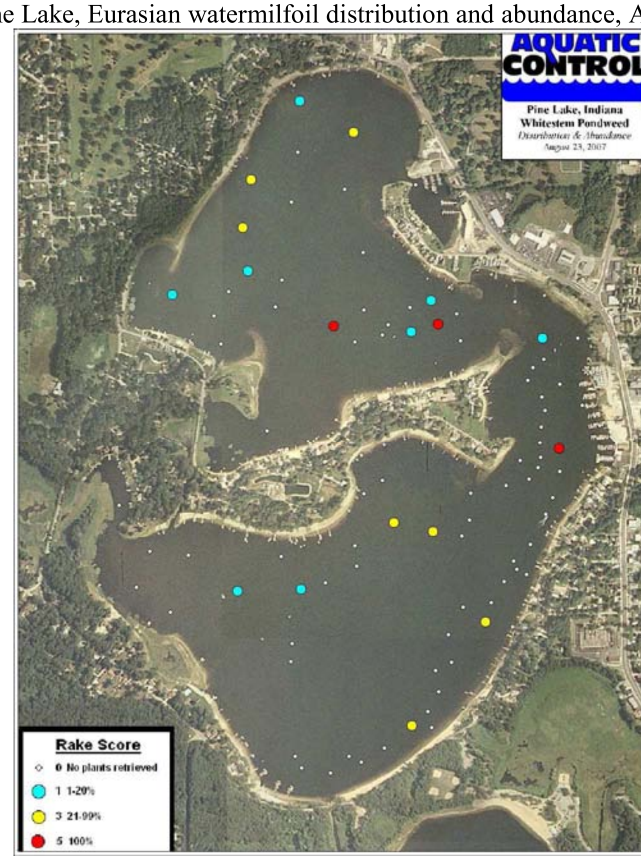


Figure 22. Pine Lake, whitestem pondweed distribution and abundance, August 23, 2007.

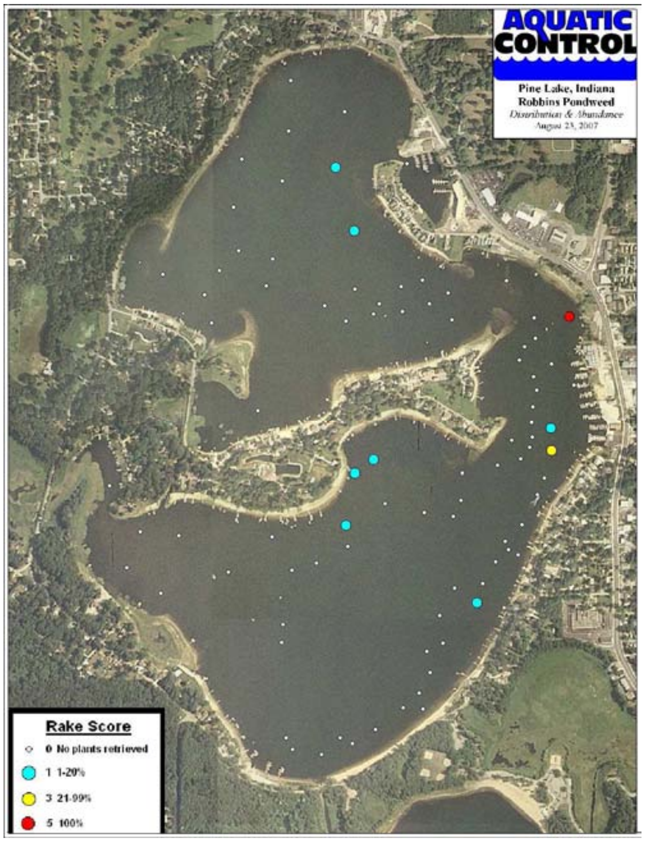


Figure 23. Pine Lake, Robbin's pondweed distribution and abundance, August 23, 2007.

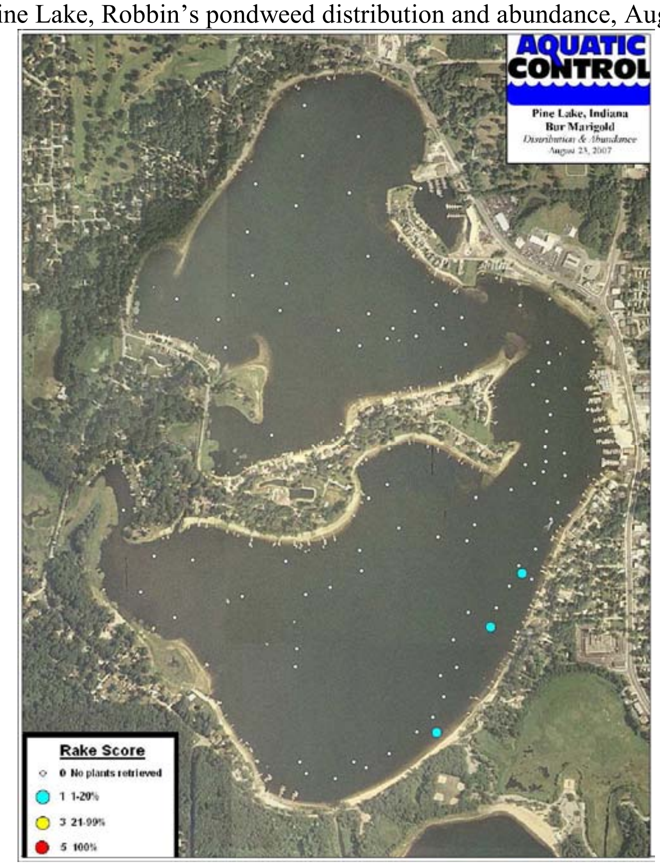


Figure 24. Pine Lake, bur marigold distribution and abundance, August 23, 2007.

*8.2.1.3 Plant Sampling Discussion*

Pine Lake contains what may be the most unique and diverse submersed plant community in the state of Indiana. In addition, Pine Lake contains thriving populations of white-stem pondweed, bur-marigold, and Robbin's pondweed which are all considered state threatened or rare species. It appears that the plant community has remained relatively stable over the last four years as illustrated in Figures 25 and 26. It is important to preserve this plant community.

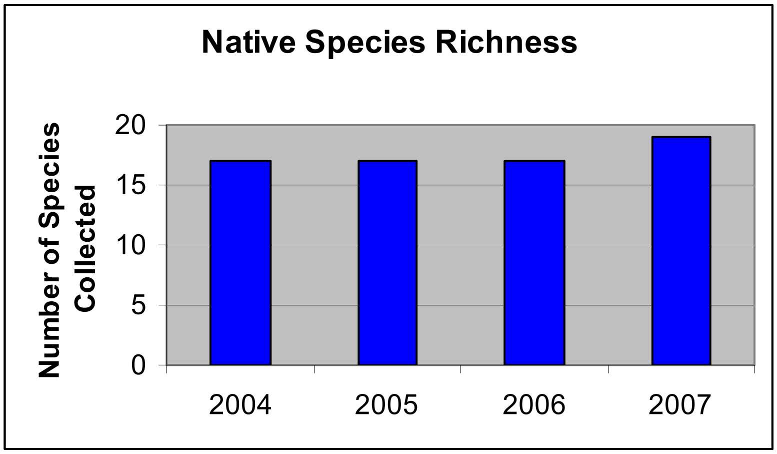


Figure 25. Pine Lake, native species richness in the last four summer Tier II surveys (2004-2006 data from Aquatic Control 2006).

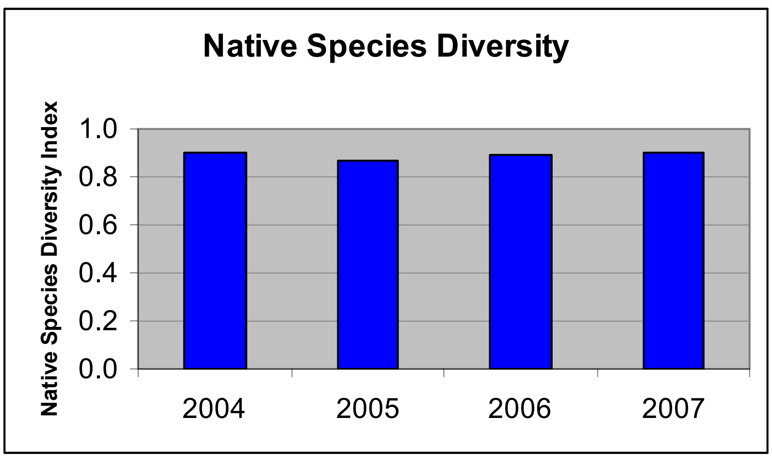


Figure 26. Pine Lake, comparison of native diversity index in the last four summer Tier II surveys (2004-2006 data from Aquatic Control 2006).

Exotic submersed plant species have gained a foothold in Pine Lake despite the presence of a dense and diverse native community. The presence of such a diverse community has likely limited the expansion of exotic vegetation. Figure 27 compares Eurasian watermilfoil frequency of occurrence data collected in the last five Tier II surveys. Selective controls with Renovate herbicide appear to have decreased the abundance of milfoil in 2005. However, the past two seasons controls have not been completed until after the LARE funded Tier II surveys. This not only offers a poor comparison to past sampling data, but likely has allowed milfoil to spread during the spring and summer. If long-term control of milfoil is going to be achieved, it is important that this species is treated in the spring.

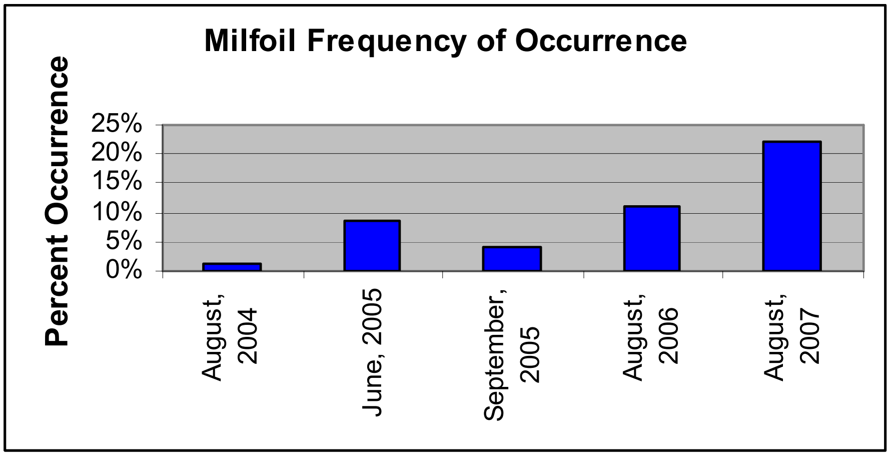


Figure 27. Pine Lake, comparison of Eurasian watermilfoil percent occurrence in the last five surveys (2004-2006 data from Aquatic Control 2006).

Next season it is recommended that Tier II sample sites be adjusted so that only the upper 20-feet is sampled. Sampling site location should also be adjusted in order to evenly sample different areas of the lake. Current Tier II sample site locations appear to be congregated near the center of the lake while areas that likely receive less wave action are not well represented.

### *8.2.2 Stone Lake*

#### *8.2.2.1 Historical Surveys*

Baetis Environmental Services (2007) completed one of the most recent surveys of Stone Lake. In 2006, they documented 34 different species including 10 different species of pondweed. Eurasian watermilfoil was the only submersed non-native species collected and it was found at only 7.1% of sites sampled. This survey also documented the presence of several state-listed rare or uncommon taxa. This included bur marigold, whitestem pondweed, Fries pondweed (*Potamogeton freisii*), stiff pondweed (*Potamogeton strictifolius*), and Robbin's pondweed. Several beds of spatterdock and white water lily were also observed.

#### *8.2.2.2 2007 Sampling Results*

On August 8, 2007 Aquatic Control completed an Invasive Species Mapping Survey on Stone Lake. A Tier II survey was completed on August 23. Twenty species were either collected or observed during the survey. Table 6 is a list of the common and scientific names of the species documented during the surveys.

**Table 6. Species list for Stone Lake**

| Scientific Name | Common Name |
|---|---|
| *Bidens beckii* | bur marigold |
| *Ceratophyllum demersum* | common coontail |
| *Chara spp.* | chara |
| *Cyperus odoratus* | fragrant flatsedge |
| *Elodea canadensis* | American elodea |
| *Myriophyllum spicatum* | Eurasian Watermilfoil |
| *Myriophyllum sibiricum* | northern watermilfoil |
| *Najas flexillis* | slender naiad |
| *Nuphar advena* | spatterdock |
| *Nymphaea odorata* | white water lily |
| *Pontederia cordata* | pickerel weed |
| *Potamogeton amplifoilus* | largeleaf pondweed |
| *Potamogeton gramineus* | variable pondweed |
| *Potamogeton praelongus* | whitestemmed pondweed |
| *Potamogeton pusillus* | small pondweed |
| *Potamogeton robbinsii* | Robbin's pondweed |
| *Potamogeton zosteriformis* | flatstemmed pondweed |
| *Sagittaria graminea* | grassy arrowhead |
| *Vallisneria americana* | eel grass |
| *Zosterella dubia* | waterstar grass |

The Invasive Species Mapping Survey was completed on August 8, 2007. Invasive species mapping located Eurasian watermilfoil within a 0.5 acre bed located in the northeast portion of Stone Lake (Figure 28.) Individual Eurasian watermilfoil plants were observed in other areas of the lake, but these plants were very scattered and never formed what could be classified as a distinct bed.


Figure 28. Stone Lake Eurasian watermilfoil location, August 8, 2007

A Tier II survey was completed on August 23, 2007 (Table 7). A Secchi depth reading was taken prior to the survey and found to be 13.0 feet. Fifty sample sites were dispersed throughout the water column in an effort to evenly sample all littoral depth ranges. Plants were collected to a maximum depth of 20 feet and were present at 48 of the 50 sample sites. A total of 15 species were collected of which 14 of the species were native. The maximum number of species per site was 8 and the mean number of species collected per site was 3.44. The mean number of native species collected per site was 3.22. The species diversity index was 0.89 and the native species diversity index was 0.88.

## Table 7. Occurrence and abundance of submersed aquatic plants in Stone Lake, August 23, 2007.

| Occurrence and abundance of submersed aquatic plants in Stone Lake | | | | | | |
|---|---|---|---|---|---|---|
| County: | LaPorte | Sites with plants: | 48 | Mean species/site: | 3.44 | |
| Date: | 8/23/2007 | Sites with native plants: | 48 | Standard error (ms/s): | 0.2712932 | |
| Secchi (ft): | 13 | Number of species: | 15 | Mean native species/site: | 3.32 | |
| Maximum plant depth (ft): | 20 | Number of native species: | 14 | Standard error (mns/s): | 0.2656375 | |
| Trophic status | Mesotrophic | Maximum species/site: | 8 | Species diversity: | 0.89 | |
| Total sites: | 50 | | | Native species diversity: | 0.88 | |
| **All depths (0 to 20 ft)** | **Frequency of** | **Rake score frequency per species** | | | | **Plant Dominance** |
| **Species** | **Occurrence** | **0** | **1** | **3** | **5** | |
| Robbin's pondweed | 58.0 | 42.0 | 2.0 | 4.0 | 52.0 | 37.2 |
| eel grass | 56.0 | 44.0 | 0.0 | 4.0 | 52.0 | 32.8 |
| common coontail | 46.0 | 54.0 | 14.0 | 6.0 | 26.0 | 15.6 |
| flatstemmed pondweed | 42.0 | 58.0 | 0.0 | 0.0 | 42.0 | 17.2 |
| large leaf pondweed | 32.0 | 68.0 | 0.0 | 0.0 | 32.0 | 18.4 |
| variable pondweed | 22.0 | 78.0 | 0.0 | 4.0 | 18.0 | 12.4 |
| slender naiad | 20.0 | 80.0 | 0.0 | 4.0 | 16.0 | 9.6 |
| whitestemmed pondweed | 18.0 | 82.0 | 0.0 | 0.0 | 18.0 | 8.4 |
| bur marigold | 16.0 | 84.0 | 2.0 | 0.0 | 14.0 | 3.2 |
| Eurasian watermilfoil | 12.0 | 88.0 | 0.0 | 2.0 | 10.0 | 4.8 |
| American elodea | 8.0 | 92.0 | 0.0 | 0.0 | 8.0 | 1.6 |
| northern watermilfoil | 6.0 | 94.0 | 4.0 | 0.0 | 2.0 | 1.2 |
| water stargrass | 4.0 | 96.0 | 0.0 | 2.0 | 2.0 | 1.6 |
| Chara | 2.0 | 98.0 | 0.0 | 2.0 | 0.0 | 0.4 |
| small pondweed | 2.0 | 98.0 | 0.0 | 0.0 | 2.0 | 0.4 |
| | | | | | | |
| **All depths (0 to 5 ft)** | **Frequency of** | **Rake score frequency per species** | | | | **Plant Dominance** |
| **Species** | **Occurrence** | **0** | **1** | **3** | **5** | |
| eel grass | 71.4 | 28.6 | 0.0 | 14.3 | 57.1 | 28.6 |
| Robbin's pondweed | 71.4 | 28.6 | 0.0 | 14.3 | 57.1 | 42.9 |
| flatstemmed pondweed | 42.9 | 57.1 | 0.0 | 0.0 | 42.9 | 14.3 |
| slender naiad | 42.9 | 57.1 | 0.0 | 14.3 | 28.6 | 25.7 |
| variable pondweed | 35.7 | 64.3 | 0.0 | 14.3 | 21.4 | 21.4 |
| large leaf pondweed | 28.6 | 71.4 | 0.0 | 0.0 | 28.6 | 5.7 |
| American elodea | 21.4 | 78.6 | 0.0 | 0.0 | 21.4 | 4.3 |
| whitestemmed pondweed | 21.4 | 78.6 | 0.0 | 0.0 | 21.4 | 12.9 |
| common coontail | 14.3 | 85.7 | 0.0 | 0.0 | 14.3 | 2.9 |
| Chara | 7.1 | 92.9 | 0.0 | 7.1 | 0.0 | 1.4 |
| | | | | | | |
| **All depths (5 to 10 ft)** | **Frequency of** | **Rake score frequency per species** | | | | **Plant Dominance** |
| **Species** | **Occurrence** | **0** | **1** | **3** | **5** | |
| Robbin's pondweed | 85.7 | 14.3 | 0.0 | 0.0 | 85.7 | 62.9 |
| large leaf pondweed | 78.6 | 21.4 | 0.0 | 0.0 | 78.6 | 58.6 |
| eel grass | 71.4 | 28.6 | 0.0 | 0.0 | 71.4 | 45.7 |
| flatstemmed pondweed | 57.1 | 42.9 | 0.0 | 0.0 | 57.1 | 20.0 |
| variable pondweed | 35.7 | 64.3 | 0.0 | 0.0 | 35.7 | 21.4 |
| bur marigold | 21.4 | 78.6 | 0.0 | 0.0 | 21.4 | 4.3 |
| common coontail | 21.4 | 78.6 | 0.0 | 0.0 | 21.4 | 7.1 |
| whitestemmed pondweed | 21.4 | 78.6 | 0.0 | 0.0 | 21.4 | 10.0 |
| Eurasian watermilfoil | 7.1 | 92.9 | 0.0 | 0.0 | 7.1 | 1.4 |
| northern milfoil | 7.1 | 92.9 | 0.0 | 0.0 | 7.1 | 1.4 |
| small pondweed | 7.1 | 92.9 | 0.0 | 0.0 | 7.1 | 1.4 |
| | | | | | | |
| **All depths (10 to 15 ft)** | **Frequency of** | **Rake score frequency per species** | | | | **Plant Dominance** |
| **Species** | **Occurrence** | **0** | **1** | **3** | **5** | |
| common coontail | 75.0 | 25.0 | 25.0 | 0.0 | 50.0 | 28.3 |
| eel grass | 58.3 | 41.7 | 0.0 | 0.0 | 58.3 | 41.7 |
| flatstemmed pondweed | 50.0 | 50.0 | 0.0 | 0.0 | 50.0 | 26.7 |
| Robbin's pondweed | 33.3 | 66.7 | 0.0 | 0.0 | 33.3 | 20.0 |
| Eurasian watermilfoil | 25.0 | 75.0 | 0.0 | 0.0 | 25.0 | 15.0 |
| slender naiad | 25.0 | 75.0 | 0.0 | 0.0 | 25.0 | 5.0 |
| whitestemmed pondweed | 25.0 | 75.0 | 0.0 | 0.0 | 25.0 | 8.3 |
| large leaf pondweed | 8.3 | 91.7 | 0.0 | 0.0 | 8.3 | 1.7 |
| variable pondweed | 8.3 | 91.7 | 0.0 | 0.0 | 8.3 | 1.7 |
| | | | | | | |
| **All depths (15 to 20 ft)** | **Frequency of** | **Rake score frequency per species** | | | | **Plant Dominance** |
| **Species** | **Occurrence** | **0** | **1** | **3** | **5** | |
| common coontail | 90.0 | 10.0 | 40.0 | 30.0 | 20.0 | 30.0 |
| Robbin's pondweed | 30.0 | 70.0 | 10.0 | 0.0 | 20.0 | 14 |
| bur marigold | 20.0 | 80.0 | 10.0 | 0.0 | 10.0 | 4 |
| Eurasian watermilfoil | 20.0 | 80.0 | 0.0 | 10.0 | 10.0 | 4.0 |
| northern milfoil | 20.0 | 80.0 | 20.0 | 0.0 | 0.0 | 4 |
| water stargrass | 20.0 | 80.0 | 0.0 | 10.0 | 10.0 | 8 |
| American elodea | 10.0 | 90.0 | 0.0 | 0.0 | 10.0 | 2.0 |
| eel grass | 10.0 | 90.0 | 0.0 | 0.0 | 10.0 | 10.0 |
| flatstemmed pondweed | 10.0 | 90.0 | 0.0 | 0.0 | 10.0 | 6 |
| slender naiad | 10.0 | 90.0 | 0.0 | 0.0 | 10.0 | 6.0 |
| | | | | | | |
| Species observed: pickerel weed, spatterdock, white water lily, fragrant flatsedge, & grassy arrowhead | | | | | | |

Robbin's pondweed, a state rare species, was collected at the highest percentage of sample sites (58.0%) and had the highest dominance index (37.2). Location and density of Robbin's pondweed is illustrated in Figure 29. Eel grass ranked second in frequency (56.0%) and dominance (32.8). Common coontail, flatstem pondweed, largeleaf pondweed, variable pondweed, slender naiad, whitestem pondweed, bur marigold, and Eurasian watermilfoil were all present at greater than 10% of sample sites. Whitestem pondweed, a state threatened species, was found at 18.0 % of sample sites (Figure 30). Bur marigold, a state rare species, occurred at 16.0% of sites (Figure 31). Eurasian watermilfoil was the only invasive species collected and it was present at 12.0% of sample sites (Figure 32).

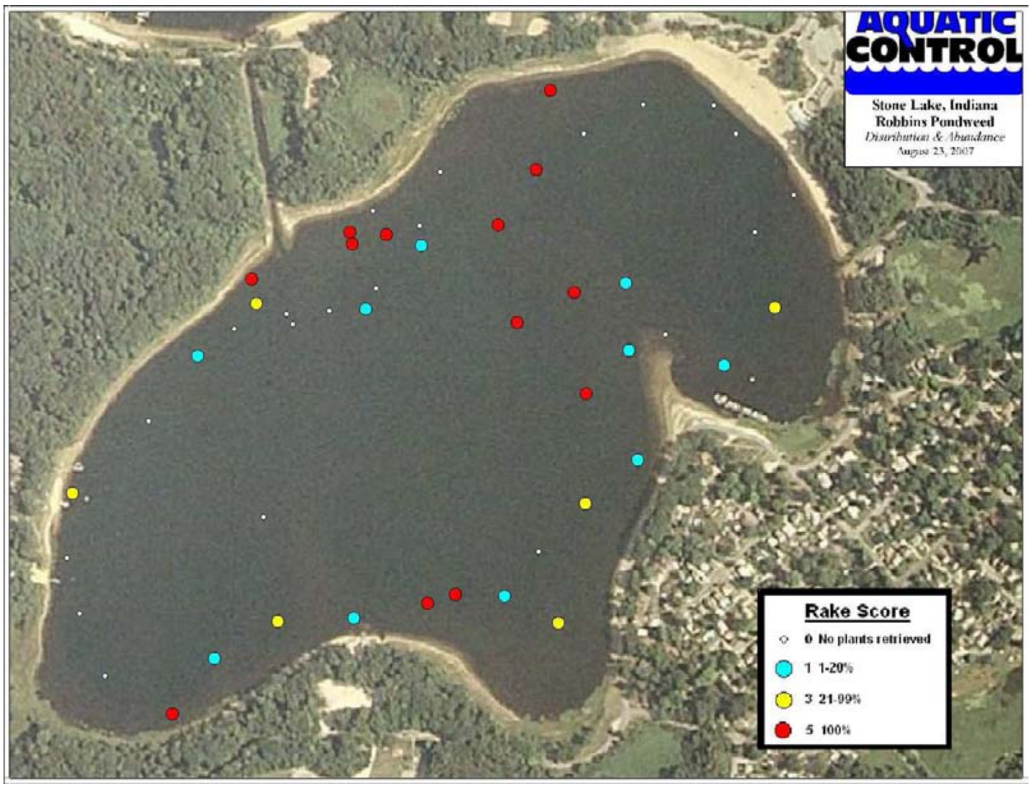


Figure 29. Stone Lake, Robbin's pondweed distribution and abundance, August 23, 2007.

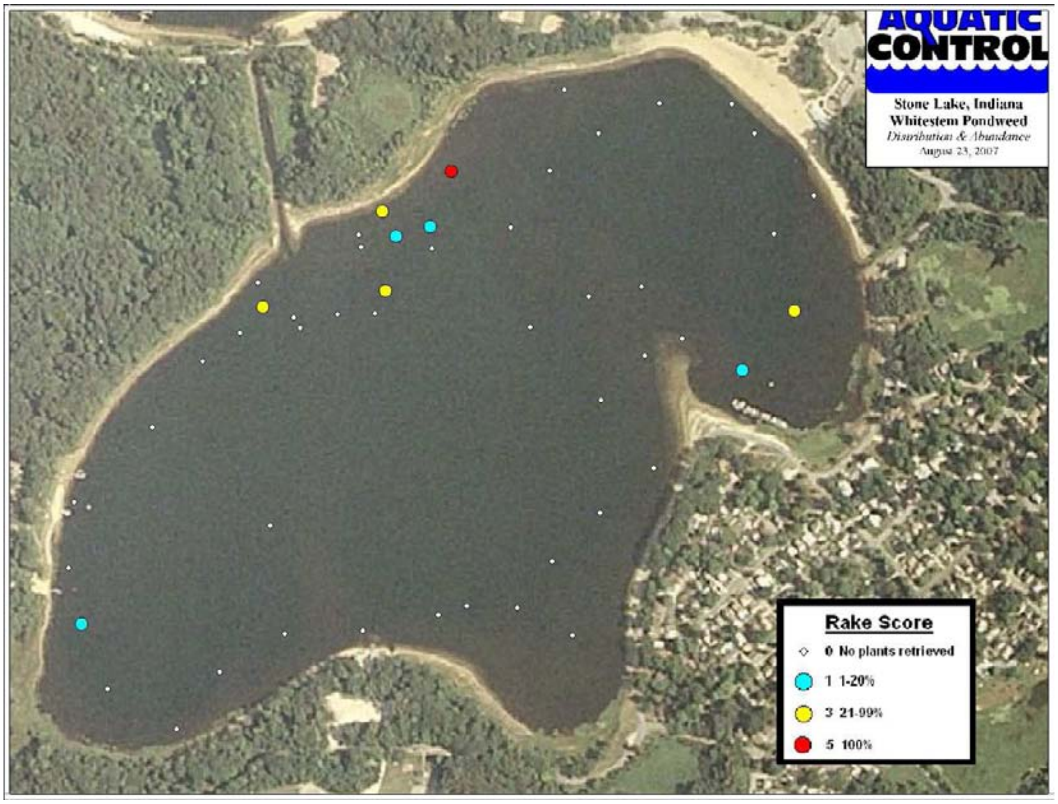


Figure 30. Stone Lake, whitestem pondweed distribution and abundance, August 23, 2007.

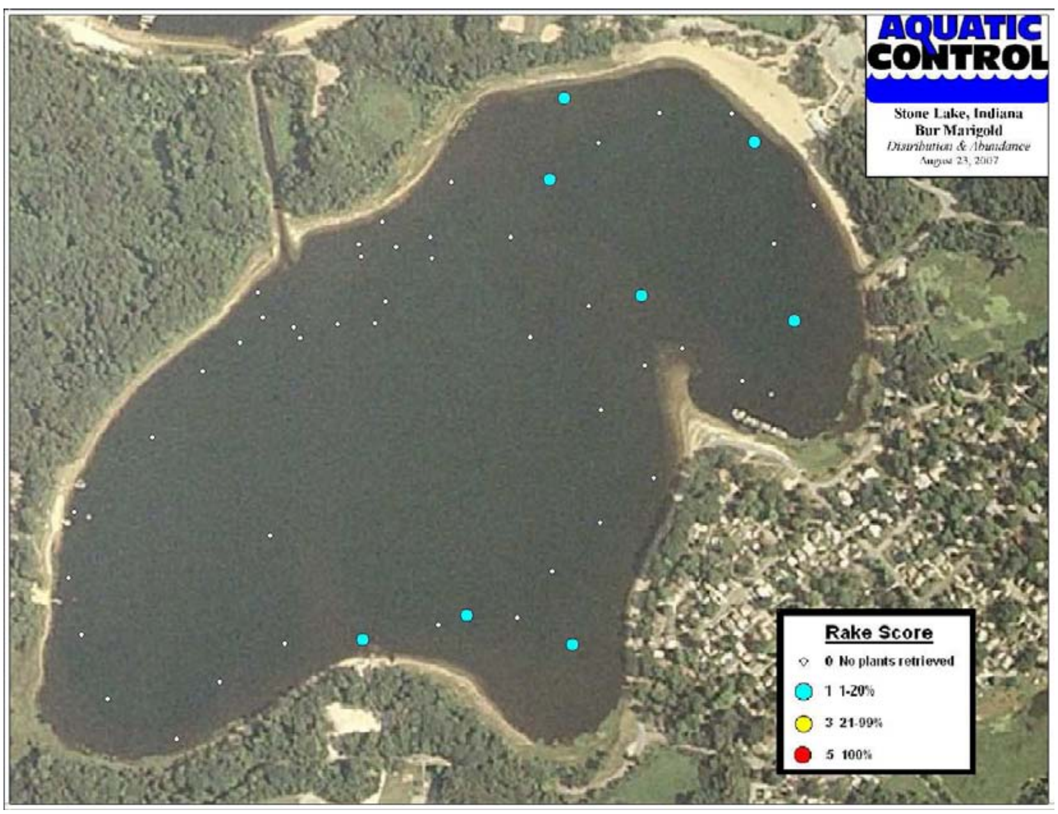


Figure 31. Stone Lake, bur marigold distribution and abundance, August 23, 2007.

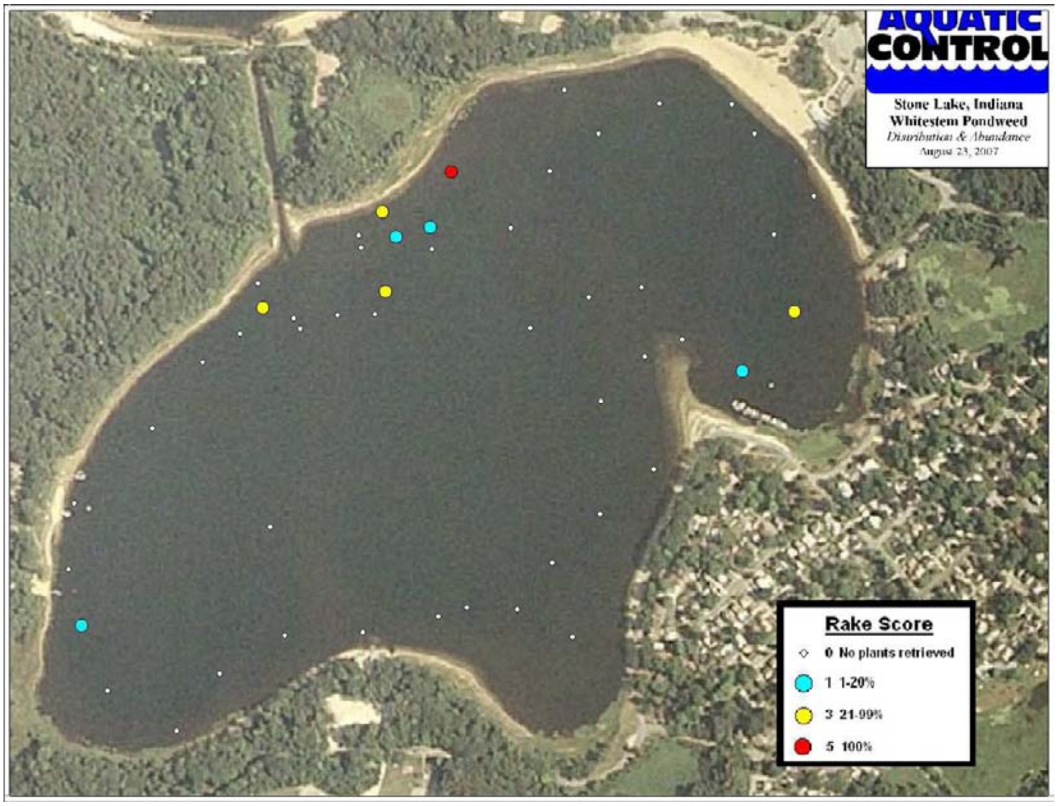

Figure 32. Stone Lake, Eurasian watermilfoil distribution and abundance, August 23, 2007.

*8.2.2.3 Plant Sampling Discussion*

Much like Pine Lake, Stone Lake contains a very diverse plant community with an abundance of state threatened or rare species. This is evidenced by the fact that Robbin's pondweed had the highest frequency of occurrence out of the 15 species collected. Exceptional water clarity, limited high speed boating, and limited development are likely three key factors in the diversity of vegetation in Stone Lake. Baetis Environmental Services (2007) concluded that Stone Lake was the most pristine of the lakes studied and had an aquatic plant community most similar to pre-European settlement conditions.

Despite the pristine condition of the aquatic plant community, Eurasian watermilfoil was collected at 12% of sample sites. Most of the milfoil collection sites were located in the northern section of the lake near the channel to Pine Lake. Unfortunately, this milfoil area was not documented in the pre-treatment invasive species mapping survey completed two weeks prior. This leads one to conclude that more rake throws and tighter boat paths need to be added to next season's invasive species sampling in order to increase accuracy.

### *8.2.3 Lily Lake*

*8.2.3.1 Historical Surveys*

Baetis Environmental Services (2007) also surveyed Lily Lake in 2006. They documented 16 different species in Lily Lake. It had the lowest number of submersed species (six) recorded for any of the studied lakes. The most predominant species was spatterdock which extended a border around the perimeter of the lake. White water lilies were often observed on the deepwater side of the spatterdock. In addition, purple loosestrife was observed in a zone to the landward side of the spatterdock. Eurasian watermilfoil was present in the lake and occurred at 18.5% of sample sites. It was also noted that Lily Lake had shown the worst decline in quality of any of the lakes that were studied (Baetis Environmental Services 2007).

*8.2.3.2 2007 Sampling Results*

On August 8, 2007 Aquatic Control completed an Invasive Species Mapping and Tier II Survey on Lily Lake. Seventeen species were either collected or observed during the survey. Table 8 is a list of the common and scientific names of the species documented during the surveys.

**Table 8. Species list for Lily Lake**

| Scientific Name | Common Name |
|---|---|
| *Cephalanthus occidentalis* | button bush |
| *Ceratophyllum demersum* | common coontail |
| *Hibiscus palustris* | swamp rose mallow |
| *Juncus spp.* | spike rush |
| *Lythrum salicaria* | purple loosestrife |
| *Myriophyllum spicatum* | Eurasian Watermilfoil |
| *Najas flexillis* | slender naiad |
| *Najas minor* | brittle naiad |
| *Nuphar advena* | spatterdock |
| *Nymphaea odorata* | white water lily |
| *Pontederia cordata* | pickerel weed |
| *Potamogeton crispus* | curlyleaf pondweed |
| *Potamogeton pectinatus* | sago pondweed |
| *Potamogeton pusillus* | small pondweed |
| *Polygonum spp.* | water smartweed |
| *Scirpus validus* | softstem bulrush |
| *Typha latifolia* | common cattail |

The Invasive Species Mapping Survey was completed on August 8, 2007. Invasive species mapping located 2.7 acres of Eurasian watermilfoil (Figure 33.) These were not especially dense milfoil beds as common coontail was more abundant in these areas than milfoil.


Figure 33. Lily Lake Eurasian watermilfoil location, August 8, 2007

A Tier II survey was also completed on August 8, 2007 (Table 9). A Secchi depth reading was taken prior to the survey and found to be 8.0 feet. Thirty sample sites were dispersed throughout the water column in an effort to evenly sample all littoral depth ranges. Plants were collected to a maximum depth of 17.0 feet and plants were present at 26 of the 30 sample sites. A total of 7 species were collected of which 5 of the species were native. The maximum number of species per site was 5 and the mean number of species collected per site was 2.23. The mean number of native species collected per site was 1.73. The species diversity index was 0.74 and the native species diversity index was 0.63.

**Table 9. Occurrence and abundance of submersed aquatic plants in Lily Lake, August 8, 2007.**

| Occurrence and abundance of submersed aquatic plants in Lily Lake | | | | | |
|---|---|---|---|---|---|
| County: | LaPorte | Sites with plants: | 26 | Mean species/site: | 2.23 |
| Date: | 8/8/2007 | Sites with native plants: | 26 | Standard error (ms/s): | 0.2382085 |
| Secchi (ft): | 8 | Number of species: | 7 | Mean native species/site: | 1.73 |
| Maximum plant depth (ft): | 17 | Number of native species: | 5 | Standard error (mns/s): | 0.1852822 |
| Trophic status | Mesotrophic | Maximum species/site: | 5 | Species diversity: | 0.74 |
| Total sites: | 30 | | | Native species diversity: | 0.63 |

| All depths (0 to 17 ft) | Frequency of Occurrence | Rake score frequency per species | | | | Plant Dominance |
|---|---|---|---|---|---|---|
| Species | | 0 | 1 | 3 | 5 | |
| common coontail | 83.3 | 16.7 | 6.7 | 6.7 | 70.0 | 67.3 |
| Brittle naiad | 56.7 | 43.3 | 0.0 | 6.7 | 50.0 | 35.3 |
| Eurasian watermilfoil | 50.0 | 50.0 | 3.3 | 6.7 | 40.0 | 24.7 |
| small pondweed | 10.0 | 90.0 | 0.0 | 0.0 | 10.0 | 2.0 |
| sago pondweed | 10.0 | 90.0 | 3.3 | 0.0 | 6.7 | 3.3 |
| slender naiad | 6.7 | 93.3 | 0.0 | 0.0 | 6.7 | 2.7 |
| curlyleaf pondweed | 6.7 | 93.3 | 0.0 | 0.0 | 6.7 | 1.3 |

| All depths (0 to 5 ft) | Frequency of Occurrence | Rake score frequency per species | | | | Plant Dominance |
|---|---|---|---|---|---|---|
| Species | | 0 | 1 | 3 | 5 | |
| common coontail | 95.7 | 4.3 | 4.3 | 8.7 | 82.6 | 78.3 |
| Brittle naiad | 73.9 | 26.1 | 0.0 | 8.7 | 65.2 | 46.1 |
| Eurasian watermilfoil | 60.9 | 39.1 | 4.3 | 8.7 | 47.8 | 31.3 |
| small pondweed | 13.0 | 87.0 | 0.0 | 0.0 | 13.0 | 2.6 |
| sago pondweed | 13.0 | 87.0 | 4.3 | 0.0 | 8.7 | 4.3 |
| slender naiad | 8.7 | 91.3 | 0.0 | 0.0 | 8.7 | 3.5 |
| curlyleaf pondweed | 8.7 | 91.3 | 0.0 | 0.0 | 8.7 | 1.7 |

| All depths (5 to 10 ft) | Frequency of Occurrence | Rake score frequency per species | | | | Plant Dominance |
|---|---|---|---|---|---|---|
| Species | | 0 | 1 | 3 | 5 | |
| common coontail | 100.0 | 0.0 | 0.0 | 0.0 | 100.0 | 100.0 |
| Eurasian watermilfoil | 50.0 | 50.0 | 0.0 | 0.0 | 50.0 | 10.0 |

| All depths (15 to 17 ft) | Frequency of Occurrence | Rake score frequency per species | | | | Plant Dominance |
|---|---|---|---|---|---|---|
| Species | | 0 | 1 | 3 | 5 | |
| common coontail | 50.0 | 50.0 | 50.0 | 0.0 | 0.0 | 10.0 |

Species observed but not sampled; pickerel weed, spatterdock, white water lily, purple loosestrife, softstem bulrush, spike rush, swamp rose mallow, water smartweed, & button bush.

Common coontail was collected at the highest percentage of sample sites (83.3%) and had the highest dominance index (66.7). Location and density of coontail is illustrated in Figure 34. Brittle naiad ranked second in frequency (56.7%) and dominance (35.3) followed by Eurasian watermilfoil which occurred at 50% of sites (Figure 35). Small pondweed and sago pondweed were each collected at 10% of samples sites while slender naiad was present at only 6.7% of sites. Curlyleaf pondweed was the only other non-native species collected and it was found at 6.7% of sites (Figure 36).

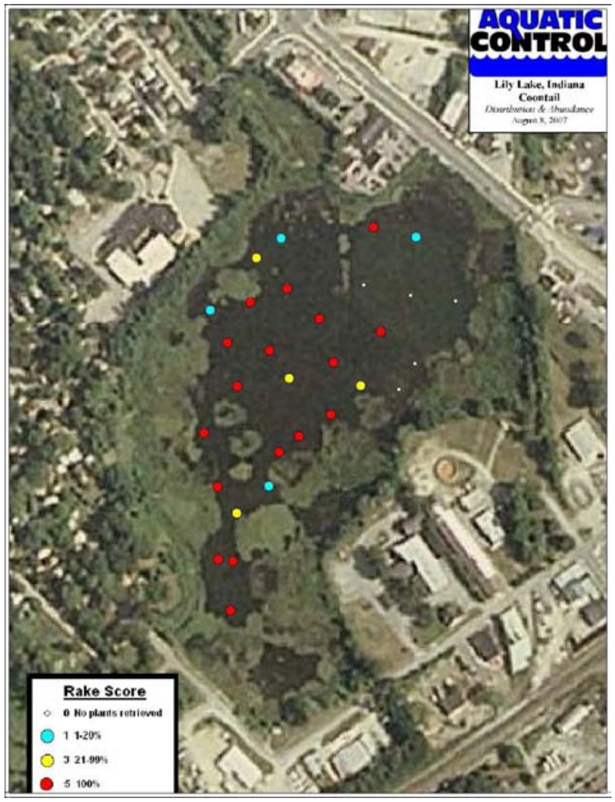


Figure 34. Lily Lake, common coontail distribution and abundance, August 8, 2007.

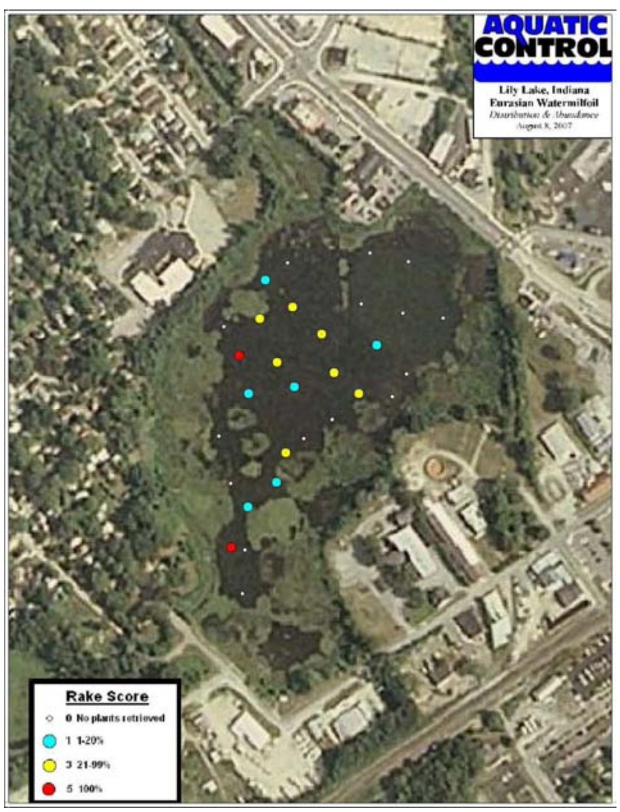


Figure 35. Lily Lake, Eurasian watermilfoil distribution and abundance, August 8, 2007.

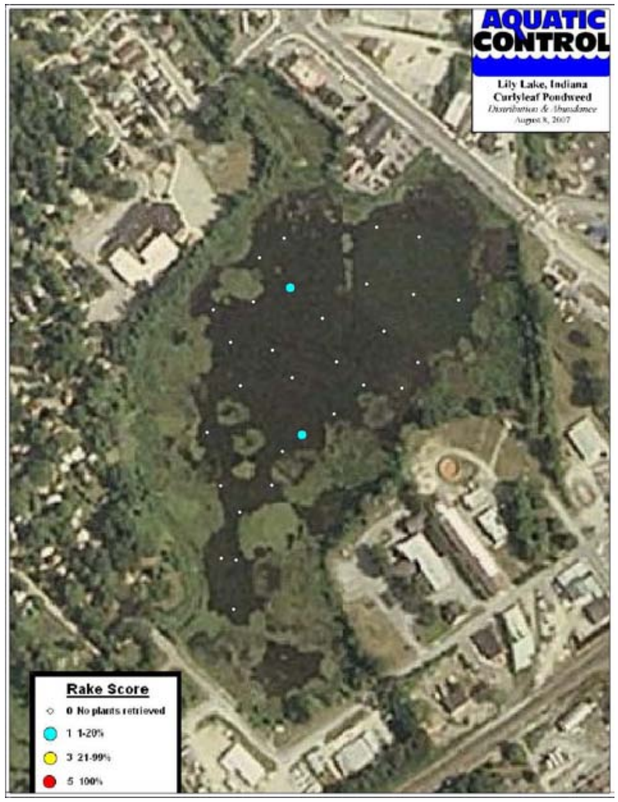


Figure 36. Lily Lake, curlyleaf pondweed distribution and abundance, August 8, 2007.

*8.2.3.3 Plant Sampling Discussion*

Lily Lake has vastly different plant community when compared to Pine and Stone Lake. The submersed plant population is dominated by species that are typically tolerant of poor water quality. Navigation through the dense beds of coontail and spatterdock was extremely difficult even with a small aluminum boat. This abundance of vegetation and shallow water likely limits recreation on Lily Lake. If there is a desire to increase lake use then steps should be taken to create boating lanes through the dense vegetation.

There were increases in submersed native species richness and water clarity when compared to 2006 sampling data (Baetis Environmental Services, 2007). Continued monitoring of the lake should allow for better detection of these potential trends. Eurasian watermilfoil also appears to have increased in abundance compared to past surveys. Baetis Environmental found Eurasian watermilfoil to be present at 18.5% of sample sites in 2006, while the 2007 Tier II survey found milfoil at 50.0% of sites. Areas where milfoil was detected were later treated with selective systemic herbicides.

### *8.2.4 Clear Lake*

*8.2.4.1 Historical Surveys*

The 2007 LaPorte Lakes Diagnostic Study also included a study of the plant community in Clear Lake. That survey documented 26 species of aquatic plants of which 12 species were classified as submersed. The aquatic plant community was dominated by Eurasian watermilfoil which was found at 94% of sites sampled. It was asserted that the density of milfoil likely led to a lower species diversity of submersed vegetation. A bed of American lotus (*Nelumbo lutea*) was also documented on the east side of the lake along with small patches of the non-native purple loosestrife along the shores of Clear Lake (Baetis Environmental Services 2007)

*8.2.4.2 2007 Sampling Results*

On August 8, 2007 Aquatic Control completed an Invasive Species Mapping and Tier II Survey on Clear Lake. Twenty species were either collected or observed during the survey. Table 10 is a list of the common and scientific names of the species documented during the surveys.

**Table 10. Species list for Clear Lake**

| Scientific Name | Common Name |
|---|---|
| *Ceratophyllum demersum* | common coontail |
| *Cyperus odoratus* | fragrant flatsedge |
| *Elodea canadensis* | American elodea |
| *Lythrum salicaria* | purple loosestrife |
| *Myriophyllum spicatum* | Eurasian Watermilfoil |
| *Najas flexillis* | slender naiad |
| *Najas minor* | brittle naiad |
| *Nelumbo lutea* | American lotus |
| *Nuphar advena* | spatterdock |
| *Nymphaea odorata* | white water lily |
| *Phragmites australis* | Common reed |
| *Pontederia cordata* | pickerel weed |
| *Potamogeton crispus* | curlyleaf pondweed |
| *Potamogeton illinoensis* | Illinois pondweed |
| *Potamogeton pectinatus* | sago pondweed |
| *Potamogeton pusillus* | small pondweed |
| *Polygonum spp.* | smart weed |
| *Sagittaria latifolia* | common arrow head |
| *Typha latifolia* | common cattail |
| *Zosterella dubia* | waterstar grass |

An Invasive Species Mapping Survey was completed on August 8, 2007. Navigation within the lake was extremely difficult due to the abundance of Eurasian watermilfoil at or just below the surface (Figure 37). Eurasian watermilfoil covered 97 acres of Clear Lake and was considered dense in all areas (Figure 38).


Figure 37. Photo of Clear Lake, August 8, 2007.

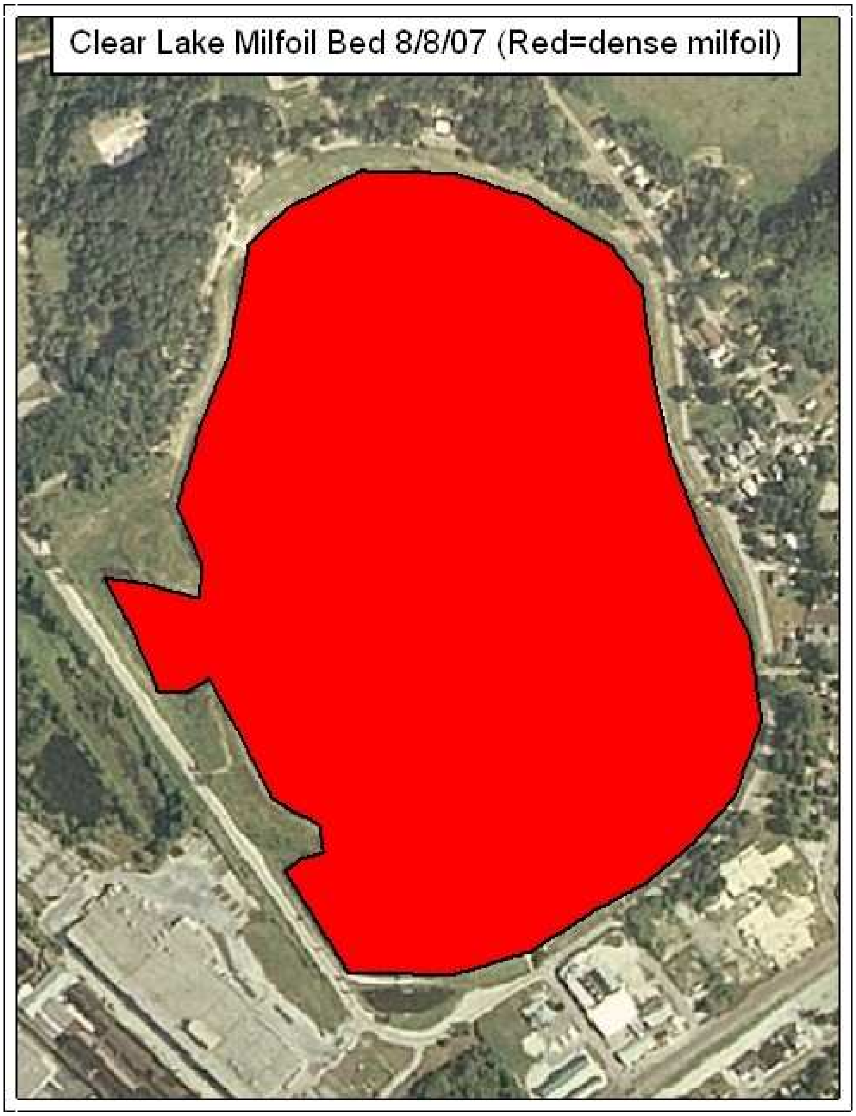


Figure 38. Clear Lake, Eurasian watermilfoil location, August 8, 2007

A Tier II survey was also completed on August 8, 2007 (Table 11). Secchi transparency was 7.0 feet. Fifty sample sites were dispersed evenly across the lake. Plants were collected to a maximum depth of 8.0 feet and were present at all 50 sample sites, but native plants were present at only 41 sites. A total of 9 species were collected of which 8 of the species were native. The maximum number of species per site was 4. The mean number of species collected per site was 2.38 and the mean number of native species collected per site was 1.38.

**Table 11. Occurrence and abundance of submersed aquatic plants in Clear Lake, August 8, 2007.**

| Occurrence and abundance of submersed aquatic plants in Clear Lake | | | | | |
|---|---|---|---|---|---|
| County: | LaPorte | Sites with plants: | 50 | Mean species/site: | 2.38 |
| Date: | 8/8/2007 | Sites with native plants: | 41 | Standard error (ms/s): | 0.1396497 |
| Secchi (ft): | 7 | Number of species: | 9 | Mean native species/site: | 1.38 |
| Maximum plant depth (ft): | 8 | Number of native species: | 8 | Standard error (mns/s): | 0.1396497 |
| Trophic status | Mesotrophic | Maximum species/site: | 4 | Species diversity: | 0.76 |
| Total sites: | 50 | | | Native species diversity: | 0.80 |

| All depths (0 to 10 ft) Species | Frequency of Occurrence | Rake score frequency per species 0 | 1 | 3 | 5 | Plant Dominance |
|---|---|---|---|---|---|---|
| Eurasian watermilfoil | 100.0 | 0.0 | 0.0 | 8.0 | 92.0 | 92.0 |
| common coontail | 48.0 | 52.0 | 0.0 | 4.0 | 44.0 | 21.6 |
| Brittle naiad | 24.0 | 76.0 | 0.0 | 4.0 | 20.0 | 10.4 |
| small pondweed | 20.0 | 80.0 | 0.0 | 2.0 | 18.0 | 4.0 |
| Illinois pondweed | 16.0 | 84.0 | 0.0 | 0.0 | 16.0 | 8.8 |
| slender naiad | 12.0 | 88.0 | 0.0 | 4.0 | 8.0 | 2.4 |
| water stargrass | 10.0 | 90.0 | 0.0 | 2.0 | 8.0 | 5.2 |
| American elodea | 6.0 | 94.0 | 0.0 | 0.0 | 6.0 | 1.2 |
| sago pondweed | 2.0 | 98.0 | 0.0 | 2.0 | 0.0 | 0.4 |

| All depths (0 to 5 ft) Species | Frequency of Occurrence | Rake score frequency per species 0 | 1 | 3 | 5 | Plant Dominance |
|---|---|---|---|---|---|---|
| Eurasian watermilfoil | 100.0 | 0.0 | 0.0 | 10.0 | 90.0 | 89.3 |
| Brittle naiad | 40.0 | 60.0 | 0.0 | 6.7 | 33.3 | 17.3 |
| common coontail | 40.0 | 60.0 | 0.0 | 3.3 | 36.7 | 22.7 |
| small pondweed | 23.3 | 76.7 | 0.0 | 3.3 | 20.0 | 4.7 |
| Illinois pondweed | 13.3 | 86.7 | 0.0 | 0.0 | 13.3 | 8.0 |
| slender naiad | 13.3 | 86.7 | 0.0 | 6.7 | 6.7 | 2.7 |
| water stargrass | 13.3 | 86.7 | 0.0 | 3.3 | 10.0 | 5.3 |
| American elodea | 10.0 | 90.0 | 0.0 | 0.0 | 10.0 | 2.0 |
| sago pondweed | 3.3 | 96.7 | 0.0 | 3.3 | 0.0 | 0.7 |

| All depths (5 to 10 ft) Species | Frequency of Occurrence | Rake score frequency per species 0 | 1 | 3 | 5 | Plant Dominance |
|---|---|---|---|---|---|---|
| Eurasian watermilfoil | 100.0 | 0.0 | 0.0 | 5.0 | 95.0 | 96.0 |
| common coontail | 60.0 | 40.0 | 0.0 | 5.0 | 55.0 | 20.0 |
| Illinois pondweed | 20.0 | 80.0 | 0.0 | 0.0 | 20.0 | 10.0 |
| small pondweed | 15.0 | 85.0 | 0.0 | 0.0 | 15.0 | 3.0 |
| slender naiad | 10.0 | 90.0 | 0.0 | 0.0 | 10.0 | 2.0 |
| water stargrass | 5.0 | 95.0 | 0.0 | 0.0 | 5.0 | 5.0 |

Species observed: curlyleaf pondweed, American lotus, common reed, purple loosestrife, spatterdock, smart weed, white water lily, pickerel weed, common cattail, fragrant sedge, & common arrowhead.

Eurasian watermilfoil was collected at every site and had a rake score of five at all but four sites (Figure 39). Location and density of Eurasian watermilfoil is illustrated in Figure 40. Common coontail ranked second in frequency (48.0%) and dominance (21.6). and location and density is illustrated in Figure 41. Brittle naiad ranked third in frequency (Figure 42) followed by small pondweed, Illinois pondweed, slender naiad, water stargrass, and American elodea.

Figure 39. Clear Lake, typical Eurasian watermilfoil dominated rake haul.

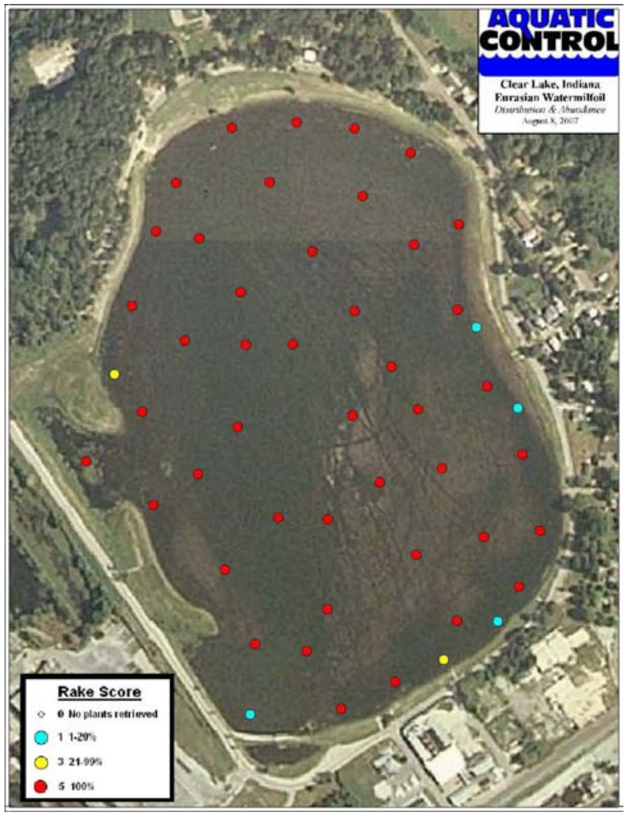


Figure 40. Clear Lake, Eurasian watermilfoil distribution and abundance, August 8, 2007.

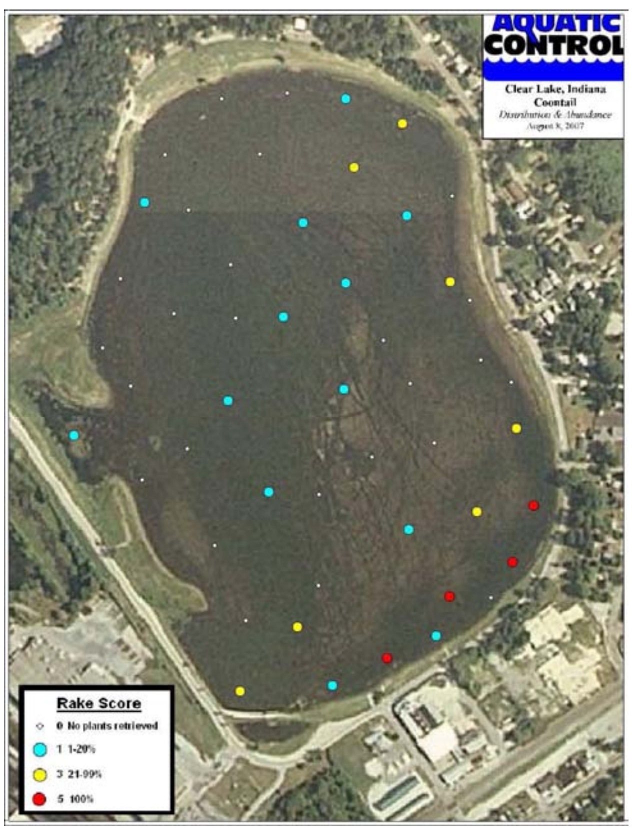


Figure 41. Clear Lake, common coontail distribution and abundance, August 8, 2007.

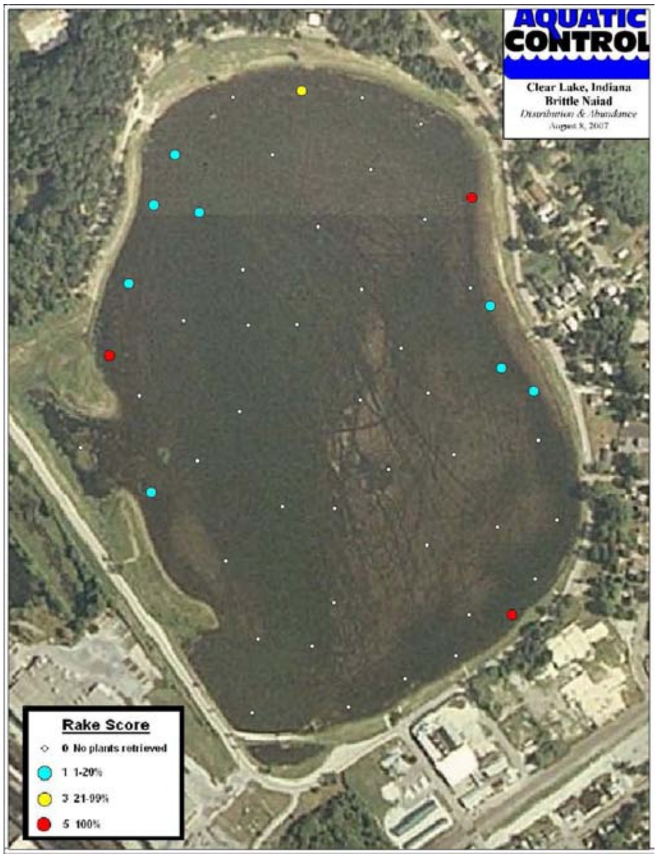


Figure 42. Clear Lake, brittle naiad distribution and abundance, August 8, 2007.

*8.2.4.3 Plant Sampling Discussion*

Clear Lake is obviously dominated by non-native Eurasian watermilfoil. This was one of the most impaired lakes we had ever come across in the Midwest. Eurasian watermilfoil was matted across the surface of a large percentage of the lake. Where it wasn't on the surface it was usually just 1-2 feet below. Navigation was very difficult, even for an experienced boat operator. It is unlikely that the majority of lake users would risk taking anything but a canoe or kayak onto Clear Lake.

Despite the abundance of Eurasian watermilfoil there was still a substantial amount of native submersed vegetation. Common coontail was growing within the milfoil beds. Small pondweed and Illinois pondweed were also found in several areas throughout the lake. In addition to the submersed vegetation, spatterdock and white water lily beds were scattered around the shoreline and a small bed of American lotus was documented growing near the western shore.

## 9.0 AQUATIC PLANT MANAGEMENT ALTERNATIVES

It appears that Eurasian watermilfoil is or has the potential of becoming the primary invasive species of concern in all four lakes. This species can create a variety of problems if left unchecked. Eurasian watermilfoil can negatively impact native species abundance, create nuisance conditions, and also negatively effect fish populations. Once established, growth and physiological characteristics of Eurasian watermilfoil enable it to form a surface canopy and develop into immense stands of weedy vegetation, out competing most submersed species and displacing the native plant community (Madsen et al., 1988). Many effective control techniques are available for targeting this species.

In order to develop a scientifically sound and effective action plan for control of nuisance vegetation, all aquatic management alternatives need to be considered. The alternatives that will be discussed include: no action; institutional; environmental manipulation; mechanical control; manual control; biological control; chemical control; and any combination of these methods.

A number of different techniques have been successfully used to control nuisance vegetation. These techniques vary in terms of their efficacy, rapidity, and selectivity, as well as the thoroughness and longevity of control they are capable of achieving. Each technique has advantages and disadvantages, depending on the circumstances. Selectivity is a particularly important characteristic of control techniques. Nearly all aquatic plant control techniques are at least somewhat selective, in that they affect some plant species more than others. Even techniques such as harvesting that have little selectivity within the areas to which they are applied can be used selectively, by choosing only certain areas in which to apply them. Selectivity can also occur after the fact, as when a technique controls all plants equally but some grow back more rapidly. One facet of selecting an appropriate aquatic plant control technique is matching the selectivity of the control technique with the goals of aquatic plant management. When controlling Eurasian watermilfoil, for example, it is typically desirable to use techniques that control Eurasian watermilfoil with minimal impact on most native species (Smith, 2002).

**9.1 No Action**

Taking no action on invasive vegetation is a potential plant management alternative. One may believe that taking no action is the cheapest alternative when it comes to aquatic vegetation management, but often times the long-term costs of no action are not considered. Not taking immediate action on several aquatic invasive species has likely allowed them spread and now Lake Associations, municipalities, and property owners have to foot the bill in order to bring their lakes back to usable shape. Unfortunately, very few of our natural aquatic areas remain that have not been impacted by man. It is our responsibility to take action in order to correct many of the mistakes we have made. This should include controlling invasive species, not only to make a lake more user friendly, but also to preserve and enhance our aquatic ecosystems.

**9.2 Cultural Control Practices**

Cultural control techniques focus on a large array of institutional and field methods used to prevent or reduce the entry or spread of invasive aquatic plant species. These processes can be an essential component of long-term management and prevention of uncontrolled aquatic weed infestations. Table 12 outlines typical program activities and processes of cultural control practices (AERF 2005).

**Table 12. Summary of cultural control strategy components for the management of aquatic weeds (modified from Madsen 1997, 2000 and cited in AERF 2005).**

| Management Method | Subcomponents | Description | Examples |
|---|---|---|---|
| Prevention | Prevent nonindigeneous introductions | Quarantine plant introductions; Institute boat cleaning or drying programs; Monitor for plant presence; Remove small colonies by hand | Citizen lake watcher programs; Volunteer compliance programs; Professional survey programs; Boat launch surveillance |
| Assessment | Examine existing and potential problem; Obtain group involvement; Study extent of the problem; Set realistic management goals; Set goals in project management framework | State problem without assuming an answer; User groups, regulatory agencies, funding agencies; Site-specific, lakewide, & watershed master plan including personnel, budget, time-line | Hydrilla or other invasive species interferes with lake use; Transect surveys; Biomass sampling; Aerial or remote sampling |
| Site-specific management | Select integrated management practices tailored to site needs and site priority; Evaluate all BMPs based on technical effectiveness and environmental and economic impacts | Low-tech approaches for small or scattered colonies; More expensive, higher tech mechanisms for larger, more dense infestations | Drinking water intakes; Endangered species; High use areas |
| Evaluation | Evaluate integrated practices quantitatively based on effectiveness and economic and environmental effects; Manage sites to economic and environmental thresholds | On-site quantitative assessment of effectiveness of integrated BMPs Environmental and economic cost benefit analysis | Quantitative plant sampling |
| Monitoring | Monitor ecosystem for change; Monitor for nonindigenous species and basic conditions of system | Limnological parameters; Measure target plant spread, nontarget impacts; effects on other species - fish, waterfowl, wildlife | Volunteers; Utilize available experts |
| Education | Public education and awareness; Educate team members; Use of opinion leaders; Target needed audience - lake users, local & regional government leaders, local & regional regulatory agencies | Public involvement to build consensus; Group education for decision making | Use of available media; Published web sites; Workshops; Lectures; Development of full-fledged public outreach program |

## 9.3 Environmental Manipulation

### *9.3.1 Water Level Manipulation*

Water level manipulation refers to the raising of water levels to control aquatic vegetation by drowning or lowering to control aquatic vegetation by exposing them to freezing, drying or heat. Use of water level manipulation for aquatic plant management is limited to lake and reservoirs with adequate water control structures. The Four Study Lakes do not have adequate water control structures, so this technique should not be considered.

### *9.3.2 Nutrient Reduction*

Plant growth can be limited if at least one nutrient, which is critical for growth, is in short supply. Nitrogen, phosphorus or carbon are usually the nutrients limiting plant growth in lakes. Therefore, if at least one of these nutrients can be limited sufficiently so that plants do not grow to a nuisance level, nutrient limitation can be used as a method of aquatic plant management. However, plants in most northern Indiana lakes have a plentiful supply of nutrients readily available from the lakes sediment. Nutrient reduction can have impacts on potentially nuisance floating plants like duckweed and watermeal. In addition, reduction in nutrient levels should lead to a decrease in nuisance algae blooms that can lead to toxin production, shading out of beneficial vegetation, a decrease in native plant diversity, taste and odor problems, and dramatic dissolved oxygen fluctuations. Overall, reduction in nutrient levels should allow for a healthier ecosystem dominated by submersed vegetation as opposed to a nutrient rich system which is often times dominated by microscopic algae blooms.

**9.4 Mechanical Control-Harvesting, Cutting, Dredging**

Mechanical control includes cutting and/or harvesting of aquatic vegetation or dredging the bottom sediments to eliminate aquatic plant growth. The main advantage to mechanical control is the immediate removal of the plant growth from control areas and the removal of organic matter and nutrients. This control technique can be effective on pioneering Eurasian watermilfoil populations if all plant fragments and root crowns are removed.

One of the most common mechanical control techniques used on larger lakes in Indiana is mechanical harvesting. Mechanical harvesting uses machines which cut plant stems and, in most cases, pick up the cut fragments for disposal. This type of mechanical control has little selectivity. Where a mix of Eurasian watermilfoil and native species exists, harvesting favors the plant species that grow back most rapidly following harvesting. In most cases, Eurasian watermilfoil recovers from harvesting much more rapidly than native plants. Thus, repeated harvesting hastens the replacement of native species by Eurasian watermilfoil and often leads to dense monocultures of Eurasian watermilfoil in frequently harvested areas (Figure 43). Harvesting also stirs up bottom sediments thus reducing water clarity, kills fish and many invertebrates, and hastens the spread of Eurasian watermilfoil via fragmentation.


Figure 43. Picture of a harvester sitting in middle of milfoil bed.

Dredging of shallow areas may reduce nuisance conditions caused by vegetation in the short-term, but studies and personal experience have shown that Eurasian watermilfoil is often the first species to colonize these disturbed areas. Dredging is expensive, especially if a nearby disposal sight is not available. Careful consideration to secondary environmental effects must be considered and permits from regulatory agencies are usually necessary before conducting dredging operations. Dredging is usually short lived if not done deeper than the photic zone.

**9.5 Manual Control-Hand Pulling, Cutting, Raking**

Removal of small amounts of vegetation by hand, which interfere with beach areas or boat docks, may be the only vegetation control necessary in some areas and has been proven effective against pioneering populations of Eurasian watermilfoil if all fragments and root crowns are removed. Of course, hand removal is labor intensive and must be conducted on a routine basis if control of all vegetation is desired. The frequency and practicality of continued hand removal will depend on availability of labor, regrowth or reintroduction potential of the vegetation, and the level of control desired (Hoyer & Canfield, 1997). Residents of the four study lakes have the option to harvest areas of submersed vegetation in and around their docks or swimming areas. Residents should keep in mind that only a 625 square foot area can be harvested without obtaining a permit from IDNR.

## 9.6 Biological Controls

Biological controls reduce aquatic vegetation using other organisms that consume aquatic plants or cause them to become diseased. The main biological controls for nuisance vegetation used in Indiana are the grass carp, milfoil weevil, and a variety of insects which prey upon purple loosestrife. Any use of biological controls or stocking fish in public waters in Indiana requires a permit from the IDNR Division of Fish and Wildlife.

### 9.6.1 Grass Carp

The grass carp (*Ctenopharyngodon idella)* is an herbivorous fish imported from Asia (Figure 44). Triploid grass carp, the sterile genetic derivative of the diploid grass carp, are legal for use in Indiana, but are not permitted for stocking in any natural lakes in the state. Grass carp tend to produce all or nothing aquatic plant control. It is very difficult to achieve a stocking rate sufficient to selectively control nuisance species without eliminating all submersed vegetation. They are not particularly appropriate for Eurasian watermilfoil control because this species is low on their feeding preference list; thus, they eat most native plants before consuming Eurasian watermilfoil (Smith, 2002). Grass carp are also difficult to remove from a lake once they have been stocked. Due to the legal concerns and ineffectiveness of the grass carp to correct the problem, grass carp are not recommended for nuisance vegetation control in the LaPorte Lakes.

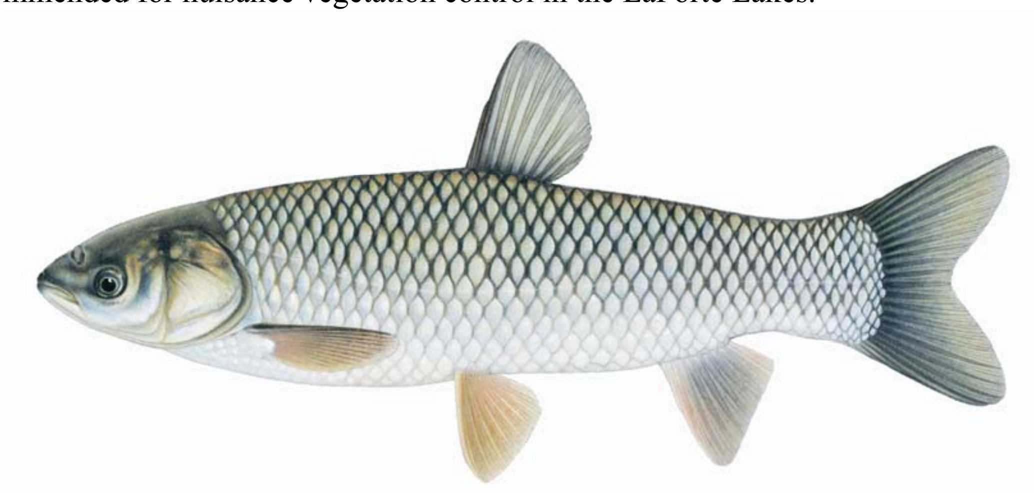

Figure 44. Illustration of grass carp.

### 9.6.2 Milfoil Weevil

The milfoil weevil, *Euhrychiopsis lecontei,* is a native North American insect that consumes Eurasian and Northern watermilfoil. The weevil was discovered following a natural decline of Eurasian watermilfoil in Brownington Pond, Vermont (Creed and Sheldon, 1993), and has apparently caused declines in several other water bodies. Weevil larvae burrow in the stem of Eurasian watermilfoil and consume the vascular tissue thus interrupting the flow of sugars and other materials between the upper and lower parts of the plant. Holes where the larvae burrow into and out of the stem allow disease organisms a foothold in the plants and allow gases to escape from the stem, causing the plants to lose buoyancy and sink (Creed et al. 1992).

Concerns about the use of the weevil as a biological control agent relate to whether introductions of the milfoil weevil will reliably produce reductions in Eurasian watermilfoil and whether the resulting reductions will be sufficient to satisfy users of the lake (Smith 2002). Following our research, no conclusive data concerning the role of weevils in consistently reducing Eurasian watermilfoil populations has been made available. In 2003, Scribailo and Alix conducted a weevil release study on three Indiana lakes and found no conclusive evidence supporting the use of weevils in reducing milfoil populations. Weevils may reduce milfoil populations in some lakes, but predicting which lakes and how much, if any, control will be achieved has not been documented (Scribailo & Alix 2003).

**9.6.3 Purple Loosestrife Insects** (Summarized from JFNew & Associates 2005)
Some control of purple loosestrife has been achieved through the use of several insects. A pilot project in Ontario, Canada reported a decrease in 95% of the purple loosestrife population from pretreatment population (Cornell Cooperative Extension, 1996 cited in JFNew 2005). Four different insects were used to achieve this control. These insects have been identified as natural predators of purple loosestrife in its native habitat. Insect releases in Indiana to date have had mixed results. After six years, the loosestrife of Fish Lake in LaPorte County is showing signs of deterioration. Likewise, seven years after the release at Pleasant Lake in St. Joseph County, purple loosestrife populations appear to have declined around the boat ramp (IDNR 2004 cited in JFNew 2005). Biological control is not a quick solution; many estimates suggest that it may take 5-15 years to achieve a large impact on purple loosestrife populations.

**9.7 Chemical Control**
Chemical control uses chemical herbicides to reduce or eliminate aquatic plant growth. One of the main perceived disadvantages to the use of chemicals is the publics concern over safety. Extensive testing is required of aquatic herbicides to ensure that the herbicides are low in toxicity to human and animal life and they are not overly persistent or bioaccumulated in fish or other organisms. It often takes several decades of testing by the Environmental Protection Agency (E.P.A.) before an herbicide is approved for aquatic use. After E.P.A approval and registration, the herbicide must go through the registration process in each state. In addition, in order to commercially apply an aquatic herbicide in the state of Indiana the applicator must pass a Category 5 aquatic applicator licensing exam and maintain continuing education credits.

Another disadvantage to the use of aquatic herbicides is water use restrictions. These restrictions must be posted prior to treatment on a public body of water. The most common restriction is irrigation. Another disadvantage to the use of herbicides is the release of nutrients that can occur if large areas of vegetation are controlled. This can be avoided by early application that controls vegetation before it reaches its maximum biomass. These perceived disadvantages are often times out-weighed by this technique's proven rapid effectiveness and potential selectivity.

There are two different types of aquatic herbicides, systemic and contact. Systemic herbicides are translocated throughout the plants and thereby kill the entire plants. Fluridone (trade name Sonar & Avast!), 2,4-D (trade name Navigate, Aqua-Kleen, & DMA4 IVM), and triclopyr (trade name Renovate) are systemic herbicides that can effectively control Eurasian watermilfoil. Triclopyr, imazypry, and glyphosate are systemic herbicides that can control purple loosestrife.

Based upon the author's experience and personal communication with an array of North American aquatic plant managers, whole-lake fluridone applications are one of the most effective means of controlling Eurasian watermilfoil. Successful fluridone treatments yield a dramatic reduction in the abundance of Eurasian watermilfoil, often reducing it to the point that Eurasian watermilfoil plants are difficult to detect following treatment (Smith 2002). An advantage to using fluridone over most contact herbicides is its selectivity. Most strains of Eurasian watermilfoil have a lower tolerance to fluridone than the majority of native species, so if the proper rates are applied Eurasian watermilfoil can be controlled with limited harm to the majority of native species.

Triclopyr is a systemic herbicide that has recently been approved for use in aquatics. Triclopyr typically is used for treating isolated milfoil beds as opposed to whole lake treatments. This herbicide is very selective to Eurasian watermilfoil. A study was conducted in 1997 during the registration process of this herbicide. The study found Eurasian watermilfoil biomass was reduced by 99% in treated areas at 4 weeks post-treatment, remained low one year later, and was still at acceptable levels of control at two years post-treatment. Non-target native plant biomass increased 500-1000% by one year post-treatment, and remained significantly higher in the cove plot at two years post-treatment. Native species diversity doubled following herbicide treatment, and the restoration of the community delayed the re-establishment and dominance of Eurasian watermilfoil for three growing seasons (Getsinger et. al., 1997). Triclopyr is a good alternative to fluridone when Eurasian watermilfoil is not abundant throughout an entire water body. It would likely be difficult to completely eliminate Eurasian watermilfoil with this type of herbicide, but an aggressive treatment program could significantly reduce milfoil density and abundance to a very manageable level. Eurasian watermilfoil must be treated everywhere it is located in the lake. The only water use restriction following a triclopyr treatment is irrigation. An assay is needed to monitor the concentration in the water before irrigation can take place. One of the historical drawbacks to using triclopyr had been the fact that only a liquid formulation was available. This can dramatically increase costs for treatment in deep water areas. In 2007, a granular formulation called Renovate OTF was approved for aquatic use in Indiana.

Applied properly, 2,4-D can also yield major reductions in the abundance of Eurasian watermilfoil. Much like triclopyr, treatments must be even and dose rates accurate. This formulation should be used much like Triclopyr. This herbicide can be applied for less cost than triclopyr, but damage may occur to coontail. 2,4-D herbicide should be considered as an alternative to triclopyr applications if the Association's budget is restricted. 2,4-D is also available in liquid and granular formulations.

Contact herbicides can also be effective for controlling submersed vegetation in the short term. The three primary contact herbicides used for control of submersed vegetation are diquat (trade name Reward), endothal (trade name Aquathol), and copper based formulations (trade names Komeen, Nautique, and Clearigate).

Historically, a drawback to the use of contact herbicides has been the lack of selectivity exhibited by these herbicides. However, a study completed by Skogerboe and Getsinger (2002) outlines how endothal can be used for control of the exotic species curlyleaf pondweed and Eurasian watermilfoil with little effect on the majority of native species. They found early season treatments with endothall effectively controlled Eurasian watermilfoil and curlyleaf pondweed at several application rates with no regrowth eight weeks after treatment. Sago pondweed, eel grass, and Illinois pondweed biomass were also significantly reduced following the endothall application, but regrowth was observed at eight weeks post-treatment. Coontail and elodea showed no effects from endothall at three of the lower application rates. Spatterdock, pickerelweed, cattail, and smartweed were not injured at any of the application rates (Skogerboe & Getsinger 2002). This type of treatment strategy could be applied to lakes that have large areas of both curlyleaf pondweed and Eurasian watermilfoil. Endothal could also be effective the year after whole lake sonar treatments where curlyleaf pondweed typically returns the following season.

Diquat and many of the copper formulations are effective fast acting contact herbicides. These formulations are typically used when control of all submersed vegetation is desired. These herbicides are commonly used for control of nuisance vegetation around docks and near-shore high-use areas. Diquat and the copper based herbicides are not as selective as many of the other herbicides and plants can recover in 4-8 weeks after treatment. There are no water use restrictions following the use of chelated copper based herbicide, which makes them popular choices for lakes used for irrigation or drinking water.

**9.8 Institutional-Protection of Beneficial Vegetation**
Presence of beneficial vegetation can inhibit the growth of species which may be more prone to create nuisance conditions. For example, if a bed of mixed pondweeds is controlled, that area could more easily become infested by Eurasian watermilfoil. Most pondweeds don't reach the surface and if they do they typically do not develop the density of a milfoil bed. Dense milfoil beds are very difficult to boat across, difficult to fish, and provide poor habitat. On the other hand, pondweeds rarely reach the density of Eurasian watermilfoil and can provide excellent habitat for fish and aquatic invertebrates. Many associations attempt to control all vegetation. This can create a competitive advantage for aggressive species like Eurasian milfoil which can quickly colonize a controlled area. Protection of beneficial vegetation should be part of any vegetation management plan. The effects of abundant native vegetation on limiting the invasiveness of Eurasian watermilfoil can be seen on Pine and Stone Lakes.

## 10.0 PUBLIC INVOLVEMENT

An effective aquatic vegetation management plan must include input from lake users. A public meeting was conducted on September 20, 2007 in LaPorte, IN. Approximately twenty-five individuals attended the meeting. The majority of those in attendance were residents of Pine Lake. Gwen White, biologist from LARE, and Casey Sullivan with LaPorte Parks and recreation, were also in attendance and helped answer questions concerning the plan.

The goals of the meeting were as follows:

1. Inform lake users of the planning process
2. Document important high-use areas of the lake
3. Educate those in attendance on aquatic plant ecology
4. Describe results of the plant sampling
5. Discuss plant management alternatives
6. Discuss implementation of the potential management strategies and monitoring programs
7. Discuss 2007 vegetation controls
8. Obtain user input by filling out a survey

A lake use survey was handed out prior to the meeting. Twenty individuals filled out the forms. The results of the survey are summarized in Table 13. According to the survey 95% were property owners and 100% were members of a lake association. A large majority of respondents lived on Pine Lake. The majority of those surveyed had lived on the lake for more than 10 years. Survey respondents indicated that boating was the most popular lake use (90%) followed by swimming (75%), fishing (55%), and aesthetics (15%). On survey questions dealing with aquatic vegetation; 65% believed vegetation interfered with lake use, 65% believed they had nuisance quantities of vegetation, 65% believed it affected property value, and 95% were in favor of continuing vegetation control efforts. In addition it appears that the audience was fairly knowledgeable concerning LARE since 90% were aware LARE funds could only be used for control of invasive exotic species. On survey questions concerning lake problems; 70% believed dredging was needed, 40% thought there were too many aquatic plants, 5% believed water quality was a problem, 30% thought the use of jet skis was an issue, 5% checked fish population as a problem, 20% believed pier funneling was a problem, 20% checked both too many boats with access, and 35% overuse by non residents as a problem. None of those surved checked “not enough aquatic plants” as a problem with the lakes.

**Table 13. LaPorte Lakes, Lake User Survey, September 20, 2007.**

| City of LaPorte Lake User Survey September 20, 2007 | | |
|---|---|---|
| Are you a lake property owner? | Yes 95% | No 5 % |
| Are you currently a member of your lake association? | Yes 100% | No 0% |
| How many years have you been at the lake? | 2 or Less: 20% | 5 to 10: 15% |
| 5% no response | 2 to 5: 15% | Over 10: 45% |
| How do you use the lake (mark all that apply) | Swimming 75% | Irrigation 10% |
| | Boating 90% | Drinking water 0% |
| | Fishing 55% | Asthetics 15% |
| Do you have aquatic plants at your shoreline in nuisance quantities? | Yes: 65% No: 35% | |
| | | |
| Does aquatic vegetation interfere with your use or enjoyment of the lake? | Yes: 65% No:25% | Undecided: 10% |
| | | |
| Does the level of vegetation in the lake affect your property values? | Yes: 65% No: 20% | Undecided: 15% |
| | | |
| Are you in favor of continuing efforts to control vegetation on the lake? | Yes: 95% No: 0% | Undecided: 5% |
| | | |
| Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded? | Yes: 90% No: 5% | Undecided: 5% |
| | | |
| Were you satisfied with the results of the LARE funded invasive treatments this season? | Yes: 55% No: 10% | Undecided: 35% |
| Mark any of these you think are problems on your lake: | | |
| 20% Too many boats access the lake | | |
| 30% Use of jet skis on the lake | | |
| 15% Too much fishing | | |
| 5% Fish population problem | | |
| 70% Dredging needed | | |
| 35% Overuse by nonresidents | | |
| 40% Too many aquatic plants | | |
| 0% Not enough aquatic plants | | |
| 5% Poor water quality | | |
| 20% Pier/funneling problem | | |

## 11.0 PUBLIC EDUCATION

In order to effectively manage aquatic vegetation lake users must gain an understanding of the ecology of the lake ecosystem and the effects individual actions may have on this resource. Annual public meetings should be completed in order to keep lake users up to date on management activities. In addition, those living on the lake should be encouraged to attend educational seminars and conferences that are offered by the Indiana Lake Management Society. There are many things that an individual can do to positively impact the quality of the LaPorte Lakes. A list of potential individual actions is listed below:

1. Reduce the frequency and amount of fertilizer, herbicide, or pesticide used for lawn care.
2. Use only phosphorus-free fertilizer.
3. Consider re-landscaping lawn edges, particularly those along the watershed's lakes, to include low profile prairie species that are capable of filtering runoff water better than turf grass
4. Consider resurfacing concrete or wooden seawalls with glacial stone, then planting native emergent vegetation along shorelines or in front of resurfaced or existing concrete or wooden seawalls to provide fish and invertebrate habitat and dampen wave energy.
5. Keep organic debris like lawn clipping, leaves, and animal waste out of the water
6. Examine all drains that lead from roads, driveways, and rooftops to the watershed
7. Obey speed limits through the lakes
8. Clean all plant fragments and sediment from boats, propellers, and trailers after lake use and refrain from dumping bait buckets into the lake to prevent the spread of exotic species. Additional information on stopping the spread of exotic species can be found at www.protectyourwaters.net.

These points should be reinforced at annual meetings and in newsletters. In addition to the individual recommendations, there are many specific recommendations that can have even greater impacts on improving the lakes which are detailed in the 2007 Diagnostic Study.

## 12.0 INTEGRATED MANAGEMENT ACTION STRATEGY

The focus of the action strategy should be designed to meet the goals and objectives of the aquatic plant management plan. To review, the goals are as follows:

1. Develop and/or maintain a stable, diverse aquatic plant community that supports a good balance of predator and prey fish and wildlife species, good water quality, and is resistant to minor habitat disturbances and invasive species
2. Direct efforts to preventing and/or controlling the negative impacts of aquatic invasive species.
3. Provide reasonable public recreational access while minimizing the negative impacts on plant and fish and wildlife resources.

Each goal, along with objectives to meet this goal, is listed below. Following each objective are the actions which should be taken in order to achieve the objective.

**12.1 Goal #1-Develop and/or Maintain Stable and Diverse Native Population**
Pine and Stone Lakes likely contain one of the most diverse plant populations in the state, while Clear and Lily Lake's populations have likely declined due to eutrophication and invasive species introductions. With this in mind, different objectives will need to be outlined for the different types of plant populations.

*Objective 1: Maintain the diversity and abundance of vegetation in Pine and Stone Lakes*
The diversity of aquatic fauna of Pine and Stone Lakes should be considered a rarity in the state of Indiana. The many benefits of this vegetation have been reviewed throughout this report. Maintaining this diversity will take vigilance on the part of lake users, Parks and Recreation staff, and IDNR. Actions that can preserve native vegetation may include protection of undeveloped areas, planting of buffer strips, education of the public on best management practices, and control of invasive species. Continued monitoring the plant population should also be continued in order to detect and address any negative trends that may occur.

*Objective 2: Enhance the diversity of beneficial native vegetation on Clear and Lily Lakes.*
Due to poor water quality, low light penetration, and an abundance of invasive species, Clear and Lily Lake have a lower diversity of native vegetation. City and State personnel can take actions that could benefit these lakes. These actions should include watershed improvements, control of invasive species, reduction of the carp population, and planting of beneficial species.

**12.2 Goal #2-Reduce Negative Impacts Caused by Exotic Vegetation**
The second goal of the vegetation management plan is to prevent and reduce negative impacts of aquatic invasive species. Goal one and two are somewhat related because one of the negative impacts of invasive species is their tendency to displace beneficial native vegetation.

*Objective 1: Reduce Eurasian watermilfoil density and abundance in all four lakes*
Clear Lake should take priority over the other three lakes due to the extent of the milfoil infestation and its effects on lake use. It is obvious that the harvesting program is not effective at controlling Eurasian watermilfoil. Whole lake fluridone treatments have historically been the most effective treatment for long-term control of large-scale Eurasian watermilfoil infestations. This technique is ideal for Clear Lake due to its low volume of water and lack of outflow. A whole-lake fluridone treatment would actually be less expensive on a per/acre basis than treatments with 2,4-D or triclopyr and much more effective than harvesting.

Spot treatments with systemic herbicides should be sufficient to control milfoil on the other three lakes. Continued monitoring of the population should be included along with vegetation controls in order to locate areas of milfoil and assess the effectiveness of controls.

Along with chemical control, it will be important for lake users to do their part in controlling Eurasian watermilfoil. Eurasian watermilfoil spreads through fragmentation, so it is easy to introduce this species to new areas. It is important that boaters avoid driving through any milfoil beds. This can chop up the plants causing them to float into new areas. It is also important that boaters check their props and trailers when traveling from lake to lake removing any plant fragments. One fragment of milfoil can lead to an entire colony. Signs should also be placed at all access points warning boaters to check for plant fragments. This is especially important since the discovery of hydrilla (*Hydrilla verticillata)* in Lake Manitou.

*Objective 2: Prevent further spread of Purple Loosestrife*
Purple loosestrife can be detrimental to native wetland species. If this species is discovered on one's property, it will be important to individual homeowners to dig up and remove the entire plant. A picture of this species is included below (Figure 45).

Figure 45. Picture of purple loosestrife (provided by: Applied biochemist)

*Objective 3: Monitor curlyleaf pondweed and control if necessary*
The exotic species, curlyleaf pondweed is common to northern Indiana lakes, and was found at low levels during surveys. This species should be monitored for the next several years in order to assess the need for control. Surveys must be completed in the spring in order to get an accurate assessment of the population.

Objective 4: *Create public awareness of the potential for hydrilla invasion and post signs for cleaning off boats at all private and public access sites*

Hydrilla, an extremely aggressive submersed aquatic plant species, has been recently discovered in Lake Manitou, which is located in north central, Indiana. Currently, it is believed that this plant is isolated in the Lake Manitou area, but much like Eurasian watermilfoil, this species has the ability to reproduce by fragmentation. This allows it to be spread easily from lake to lake. It is very important that lake users understand the importance of thoroughly cleaning off their boats when entering and exiting the lakes. Posting signs at the ramp will help reinforce this point. Warnings about this plant should also be sent to members of the Association. The best way to distinguish hydrilla from native elodea is that hydrilla typically has five leaves along each whorl along with visible serrated edges along the leaf margin (Figure 46). More information about controlling the spread of hydrilla can be found at www.protectyourwaters.net.

Figure 46. Illustration of hydrilla on the left compared to native elodea on the right. Hydrilla typically contains five toothed leaves per whorl while native elodea typically has three leaves per whorl and the teeth are not visible on the leaves (Illustrations provided by Applied Biochemist).

## 12.3 Goal #3: Provide Reasonable Recreational Access While Minimizing the Negative Impacts on Plant, Fish, and Wildlife Resources

The focus of plant control should be on nuisance non-native species, but even if all non-native species were eliminated it may be necessary to control some native vegetation in order to provide access to docks and high-use areas.

*Objective 1: Control only nuisance vegetation around docks, beaches, boat ramps and high use areas of Pine, Clear, and Stone Lakes*

If left unchecked, some homeowners may be negatively impacted by native vegetation. Some homeowners may have the ability to physically remove the vegetation from these areas (625 square feet can be removed without a permit). It is recommended that if possible, and if needed, homeowners control only 625 square feet. However, some areas may be too dense or some homeowners may not be capable of completing this task. In this case it will be necessary to contact professionals to complete the work. Applied properly, aquatic herbicides are typically the best all around method for control of dense vegetation growth. Treatment should be limited to near shore high-use areas. Width of shoreline treatments should not exceed 100 feet out from shore. Treatment of rooted floating vegetation should be limited to a wide enough area for boats to pass (20-30 feet). It has also been IDNR's policy to only permit treatment of native vegetation in half of the shoreline areas of any given lake.

**12.4 List of Actions To Be Initiated**

Listed below, in order of importance, are recommended actions designed to meet the goals and objectives of the aquatic vegetation management plan. Some of these actions may be funded by LARE, but many will require funds from the City of LaPorte. At the public meeting, a large majority of residents supported these potential actions, especially those concerning improvement on Clear Lake.

1. Complete a whole-lake fluridone treatment on Clear Lake in the spring of 2008. This treatment should effectively control Eurasian watermilfoil for several seasons. Low doses of fluridone should be applied in order to reduce damage to the less susceptible native species. The initial dose should be applied with a 6 ppb dose of Sonar AS and maintained with "bump" applications as needed. Residue monitoring should be collected at two locations at 3, 14, 21, 42, 60, 90, and 120 days after treatment in order to determine when a bump application is necessary. The concentration should be bumped back to 6 ppb after the 14 or 21 day residue samples have been analyzed. Greater than 2 ppb should be maintained in Clear Lake following the first "bump" application for 90-120 days (recommendation from personal communication with Dr. Tyler Koschnick of SePRO corporation).

2. Continue spot controls of Eurasian watermilfoil on Pine, Lily, and Stone Lakes with systemic Renovate 3 or 2,4-D herbicides. It is estimated that 20-25 acres may require treatment. Renovate should be used in areas bigger than 5 acres with an average depth less than 6.0 feet. Granular 2,4-D should be used in areas that are either less than 5.0 acres or that have an average depth greater than 6.0 feet.

3. Complete Invasive Species Sampling in the spring of 2008 on Pine, Lily, and Stone Lakes in order to map out Eurasian watermilfoil treatment areas. These surveys should also be used to get an acreage assessment on curlyleaf pondweed. Invasive species surveys should be completed on all four lakes in 2009-2011. These surveys area especially important for Clear Lake in order to document any areas of potential Eurasian watermilfoil reinfestation.

4. Continue summer Tier II surveys on all four lakes, at least through 2011, in order to monitor the changes in the native plant population and assess the effectiveness of vegetation controls.

5. Post "Stop Aquatic Hitchhiker" signs at all boat ramps in order to encourage boaters to clean off all plant fragments from their boats and trailers. This point should also be reinforced at Association meetings, newsletters, and on Association and City websites.

6. Take steps to improve water quality in Clear and Lily Lakes. Potential actions are outlined in the 2007 Diagnostic Study.

7. Take steps to preserve remaining natural areas around Stone Lake and educate residents of Pine Lake on Best Management Practices for shoreline and property maintenance.

8. Maintain dock, boat ramp, and boat path areas with physical plant removal when possible or by contracting professional applicators. Treatments should not exceed 100 feet from shoreline for submersed vegetation and treatment of rooted floating vegetation should be limited to boating lanes.

9. Remove purple loosestrife from individuals' property and pursue funding source to biological controls.

**13.0 PROJECT BUDGET**

Table 14 is an estimated budget for the aquatic vegetation management action plan. The most difficult part of making this budget is predicting the amount of milfoil that will return. Plant sampling will be one of the most important actions in order to monitor the effects of the control techniques. Sampling should consist of a spring invasive mapping survey on Pine, Stone, and Lily Lakes, to map treatment areas along with a Tier II survey in the summer. It is proposed that LARE fund treatment of milfoil and plant survey updates (this will require a 10% match from the City). **It is our recommendation that the City of LaPorte Parks Department requests LARE for $14,000 for a whole lake treatment on Clear Lake, $11,000 for spot treatments for control of milfoil in Pine, Stone, and Lily Lakes, and $8,000 for vegetation sampling and plan updates.** A permit has been created for the milfoil treatments and is included in the Appendix.

**Table 14. Budget estimate for top three items in action plan**

| | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|
| Whole Lake Fluridone Treatment on Clear Lake | $14,000 | - | - | - | - |
| Selective treatment of Eurasian watermilfoil with Renovate or 2,4-D herbicide | $11,000 | $9,000 | $7,000 | $6,000 | $5,000 |
| Plant sampling and plan updates (potential LARE funding with 10% match) | $8,000 | $8,000 | $8,000 | $8,000 | $8,000 |
| **Total:** | **$33,000** | **$17,000** | **$15,000** | **$14,000** | **$13,000** |

*Request $32,000 from LARE program in 2008.

## 14.0 MONITORING AND PLAN UPDATE PROCEDURES

One of the most important actions in the aquatic vegetation management plan is the continued monitoring of the plant population. Continued monitoring will provide valuable data to the aquatic plant manager. This data can be used to complete the following tasks: allow for needed changes to be made to the plan; monitor success or failure of controls; monitor improvements or damage to native plants; and detect potential new invasive species at an early stage of infestation. In 2008, monitoring should consist of a Spring Invasive Species Survey on Pine, Stone, and Lily Lakes with a Tier II survey in July or August on all four lakes. The Tier II survey provides managers with quantitative data that can point out trends in the plant community. Each winter this data should be analyzed and included in an update to the aquatic vegetation management plan. The surveys may lead to changes in the recommended actions of the plan.

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# 16.0 APPENDICIES

## 16.1 Data Sheets

### *16.1.1 Pine Lake*

| | | | | 4.00000 | | | | Eurasian watermilfoil *(Myriophyllum spicatum)* | common coontail *(Ceratophyllum demersum)* | Chara (Chara spp.) | Slender naiad *(Najas flexilis)* | sago pondweed *(Potamogeton pectinatus)* | eel grass *(Vallisneria americana)* | American elodea *(Elodea canadensis)* | southern naiad *(Najas guadalupensis)* | flatstemmed pondweed *(Potamogeton zosteriformis)* | large leaf pondweed *(Potamogeton amplifolius)* | variable pondweed *(Potamogeton gramineus)* | northern watermilfoil *(Myriophyllum sibiricum)* | variable milfoil *(Myriophyllum heterophyllum)* | whitestemmed pondweed *(Potamogeton praelongus)* | water stargrass *(Zosterella dubia)* | bur marigold *(Bidens beckii)* | Illinois pondweed *(Potamogeton illinoensis)* | Robbin's pondweed *(Potamogeton robbins)* | white water buttercup *(Ranunculus longirostris)* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lake | Date | Latitude | Longitude | Design | Site | Depth | RAKE | MYSP2 | CEDE4 | CH?AR | NAFL | POPE6 | VAAM3 | ELCA7 | NAGU | POZO | POAM | POGR8 | MYSI | MYHE | POPR5 | ZODU | BIBE | POIL | PORO2 | RALO |
| Pine Lake | 8/23/07 | 41.629031 | -86.739761 | | 1 | 4.0 | 5 | | | | | | 3 | 3 | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.629655 | -86.740657 | | 2 | 23.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.630381 | -86.741274 | | 3 | 10.0 | 3 | 1 | 3 | | | | 1 | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.63101 | -86.739945 | | 4 | 4.0 | 5 | | 1 | | | | 1 | 3 | | | | 1 | | | | | | | 5 | |
| Pine Lake | 8/23/07 | 41.630991 | -86.741339 | | 5 | 6.0 | 3 | 1 | | 1 | | | 1 | | | 1 | | | | | 1 | | | | | |
| Pine Lake | 8/23/07 | 41.632078 | -86.742411 | | 6 | 2.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.630935 | -86.744553 | | 7 | 4.0 | 5 | 3 | | | 1 | | | 1 | 1 | | | 5 | | | | | | | | |
| Pine Lake | 8/23/07 | 41.631717 | -86.744689 | | 8 | 6.0 | 5 | | | | | | | | | | | | 1 | | | | | | | |
| Pine Lake | 8/23/07 | 41.632098 | -86.745696 | | 9 | 6.0 | 5 | | | | 3 | | 3 | | | | | | 1 | | 1 | | | | | |
| Pine Lake | 8/23/07 | 41.631394 | -86.747388 | | 10 | 19.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.631822 | -86.748357 | | 11 | 25.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.63353 | -86.748384 | | 12 | 6.0 | 5 | | 1 | | 1 | | 5 | 1 | | | | | 5 | | | | | | 1 | |
| Pine Lake | 8/23/07 | 41.635358 | -86.749105 | | 13 | 6.0 | 5 | | 1 | | 1 | | | | | 3 | | 5 | 1 | | | | | | 1 | |
| Pine Lake | 8/23/07 | 41.635503 | -86.74631 | | 14 | 4.0 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.637031 | -86.748758 | | 15 | 6.0 | 5 | | | | | | | 3 | | | | | | | 3 | | | | | |
| Pine Lake | 8/23/07 | 41.637936 | -86.750869 | | 16 | 8.0 | 5 | 5 | 5 | | | | 1 | | | | | | | | 1 | | | | | |
| Pine Lake | 8/23/07 | 41.636457 | -86.750947 | | 17 | 23.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.63499 | -86.751187 | | 18 | 20.0 | 1 | | 1 | | | | | | | 1 | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.635624 | -86.752773 | | 19 | 9.0 | 5 | | | | | | 5 | | | 1 | | | | | 3 | | | | | |
| Pine Lake | 8/23/07 | 41.634218 | -86.7531 | | 20 | 6.0 | 5 | 1 | | | | | 3 | | | | | | | | 3 | | | | | |
| Pine Lake | 8/23/07 | 41.632955 | -86.752898 | | 21 | 18.0 | 5 | | 5 | | | | | | | 5 | | | | | 1 | | | | | |
| Pine Lake | 8/23/07 | 41.632706 | -86.751571 | | 22 | 24.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.632378 | -86.753658 | | 23 | 23.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.632263 | -86.755868 | | 24 | 4.0 | 5 | | | | | | 1 | | | 5 | | | | | 1 | | | | | |
| Pine Lake | 8/23/07 | 41.631667 | -86.754233 | | 25 | 17.0 | 3 | | 3 | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.63084 | -86.753957 | | 26 | 4.0 | 3 | 1 | | | 1 | | 3 | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.631926 | -86.751816 | | 27 | 7.0 | 5 | | | | | | 3 | | | | | | | | 5 | | | | | |
| Pine Lake | 8/23/07 | 41.631343 | -86.74952 | | 28 | 8.0 | 5 | | | | | | 5 | | | | | | | | 5 | | | | | |
| Pine Lake | 8/23/07 | 41.628279 | -86.752158 | | 29 | 4.0 | 5 | 3 | | | 1 | | | 3 | | | | 5 | | | | | | | | |
| Pine Lake | 8/23/07 | 41.630897 | -86.748707 | | 30 | 18.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.63109 | -86.747629 | | 31 | 16.0 | 5 | | 5 | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.631175 | -86.746476 | | 32 | 6.0 | 5 | | | | | | 1 | | | | 5 | | | | 1 | | | | | |
| Pine Lake | 8/23/07 | 41.631907 | -86.746544 | | 33 | 9.0 | 5 | 3 | | | 3 | | 5 | 1 | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.631391 | -86.74543 | | 34 | 7.0 | 5 | | | | | | 3 | | | 3 | 1 | | | | 5 | | | | | |
| Pine Lake | 8/23/07 | 41.630141 | -86.741713 | | 35 | 16.0 | 1 | | 1 | | | | | | | | | | 1 | | | | | | | |
| Pine Lake | 8/23/07 | 41.629754 | -86.741896 | | 36 | 22.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.629272 | -86.741363 | | 37 | 26.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.628382 | -86.741373 | | 38 | 13.0 | 5 | | 5 | | | | | | | | | 3 | | | | 3 | | | | |
| Pine Lake | 8/23/07 | 41.627916 | -86.741433 | | 39 | 16.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.62739 | -86.7422 | | 40 | 14.0 | 5 | | 1 | | | | 5 | 1 | | | | | 5 | | | | | | | |
| Pine Lake | 8/23/07 | 41.626838 | -86.741852 | | 41 | 25.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.626654 | -86.742774 | | 42 | 8.0 | 5 | | 5 | | | | 3 | | | | | 1 | 5 | | | | | | | |
| Pine Lake | 8/23/07 | 41.626436 | -86.744148 | | 43 | 6.0 | 5 | | | | 3 | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.625635 | -86.744192 | | 44 | 19.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.625174 | -86.744501 | | 45 | 22.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.625286 | -86.745619 | | 46 | 9.0 | 5 | | | | | | | | | | | 3 | 1 | | 3 | | | | | |
| Pine Lake | 8/23/07 | 41.625555 | -86.747172 | | 47 | 13.0 | 5 | | 3 | | | | | | | | | | 1 | | 3 | | | | | |
| Pine Lake | 8/23/07 | 41.626801 | -86.747617 | | 48 | 6.0 | 5 | 3 | | | 1 | | | | | | | 1 | 1 | | | | | | 1 | |
| Pine Lake | 8/23/07 | 41.626422 | -86.748354 | | 49 | 3.0 | 5 | | | | | | 1 | 1 | | 5 | | | | | | | | | 1 | |
| Pine Lake | 8/23/07 | 41.6249 | -86.748696 | | 50 | 9.0 | 5 | 1 | 1 | | | | 1 | | | | | 3 | 3 | | | | | | 1 | |
| Pine Lake | 8/23/07 | 41.624281 | -86.748636 | | 51 | 24.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.623808 | -86.749849 | | 52 | 21.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.623586 | -86.750821 | | 53 | 14.0 | 5 | | | | | | 3 | | | 1 | | 3 | 1 | | 1 | | | | | |
| Pine Lake | 8/23/07 | 41.624572 | -86.751595 | | 54 | 4.0 | 5 | | | | 3 | | | 1 | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.623538 | -86.753307 | | 55 | 5.0 | 3 | | | | | | 1 | | | | | 1 | 1 | | 1 | | | | | |
| Pine Lake | 8/23/07 | 41.624602 | -86.755242 | | 56 | 4.0 | 3 | 1 | | | 1 | | | 1 | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.624715 | -86.756743 | | 57 | 3.0 | 3 | 1 | | | | 1 | 3 | | | | | | 1 | | | 1 | | | | |
| Pine Lake | 8/23/07 | 41.626073 | -86.757971 | | 58 | 2.0 | 5 | | | | | | | | | | | | | 5 | | | | | | |
| Pine Lake | 8/23/07 | 41.623675 | -86.757291 | | 59 | 3.0 | 5 | | | | 3 | | | 1 | | | | 1 | | | | 3 | | | | |
| Pine Lake | 8/23/07 | 41.622939 | -86.755943 | | 60 | 3.0 | 2 | | | | | | | | | | | 3 | | | | | | | | |
| Pine Lake | 8/23/07 | 41.622011 | -86.751159 | | 61 | 14.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.621495 | -86.751209 | | 62 | 19.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.618695 | -86.751041 | | 63 | 25.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.618365 | -86.750796 | | 64 | 19.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.618216 | -86.749656 | | 65 | 12.0 | 5 | | | | | | 5 | | | 1 | 3 | | 1 | | | | | | | |
| Pine Lake | 8/23/07 | 41.618698 | -86.748917 | | 66 | 23.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.618536 | -86.748452 | | 67 | 8.0 | 5 | | 3 | | | | 5 | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.618954 | -86.747553 | | 68 | 9.0 | 5 | | 3 | | | | 5 | | | | | | | | | | | | | 1 |
| Pine Lake | 8/23/07 | 41.619594 | -86.746452 | | 69 | 11.0 | 5 | 3 | 3 | | | | 5 | | | | | | | | 3 | | | | | |
| Pine Lake | 8/23/07 | 41.619547 | -86.745686 | | 70 | 6.0 | 5 | | | | 1 | 1 | 3 | 3 | | | | | 3 | | | 1 | 1 | | | 1 |
| Pine Lake | 8/23/07 | 41.620027 | -86.745824 | | 71 | 13.0 | 3 | 1 | 1 | | | | 3 | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.620607 | -86.745397 | | 72 | 9.0 | 5 | | 3 | | 1 | | | | | | | 3 | 1 | | | | | | | |
| Pine Lake | 8/23/07 | 41.621226 | -86.745541 | | 73 | 13.0 | 5 | 3 | 5 | | | | 5 | | | | | | 3 | | | | | | | |
| Pine Lake | 8/23/07 | 41.62147 | -86.744888 | | 74 | 8.0 | 5 | 3 | | | 1 | | 5 | 1 | | 1 | | 5 | 1 | | | | | | | 1 |
| Pine Lake | 8/23/07 | 41.622286 | -86.745035 | | 75 | 17.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.623084 | -86.744456 | | 76 | 24.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.62263 | -86.743571 | | 77 | 10.0 | 5 | | | | 1 | | 5 | | | | | 5 | | 1 | 3 | | 1 | | 1 | 1 |
| Pine Lake | 8/23/07 | 41.623224 | -86.743335 | | 78 | 21.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.623836 | -86.742831 | | 79 | 16.0 | 1 | | 1 | | | | 1 | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.624043 | -86.741958 | | 80 | 6.0 | 5 | | | | 1 | | 1 | | | | | 5 | | | | | | | | |
| Pine Lake | 8/23/07 | 41.624191 | -86.742322 | | 81 | 8.0 | 5 | | 5 | | | | 3 | 1 | | | | 5 | | | | | 1 | 1 | | |
| Pine Lake | 8/23/07 | 41.624436 | -86.742468 | | 82 | 20.0 | 0 | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.624927 | -86.74181 | | 83 | 7.0 | 5 | 5 | 5 | | | | 3 | 1 | | | | 3 | | | | | | | | |
| Pine Lake | 8/23/07 | 41.62582 | -86.741211 | | 84 | 20.0 | 1 | | | | | | 1 | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.6263 | -86.740926 | | 85 | 14.0 | 3 | 1 | 3 | | | | 1 | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.627064 | -86.740641 | | 86 | 9.0 | 5 | | 5 | | | | 5 | | | | | 3 | | | | | | 1 | 3 | |
| Pine Lake | 8/23/07 | 41.627738 | -86.740683 | | 87 | 9.0 | 5 | 5 | | | | | 5 | 1 | | | | | | | 5 | 1 | | 5 | 1 | |
| Pine Lake | 8/23/07 | 41.627177 | -86.741497 | | 88 | 0.0 | | | | | | | | | | | | | | | | | | | | |
| Pine Lake | 8/23/07 | 41.627492 | -86.741404 | | 89 | 0.0 | | | | | | | | | | | | | | | | | | | | |

## 16.1.2 Stone Lake

| Lake | Date | Latitude | Longitude | Design | Site | Depth | RAKE | Eurasian watermilfoil (*Myriophyllum spicatum*) MYSP2 | common coontail (*Ceratophyllum demersum*) CEDE4 | Chara (Chara spp.) CH?AR | Slender naiad (*Najas flexilis*) NAFL | small pondweed (*Potamogeton pusillus*) POPU7 | eel grass (*Vallisneria americana*) VAAM3 | American elodea (*Elodea canadensis*) ELCA7 | flatstemmed pondweed (*Potamogeton zosteriformis*) POZO | large leaf pondweed (*Potamogeton amplifolius*) POAM | variable pondweed (*Potamogeton gramineus*) POGR8 | northern watermilfoil (*Myriophyllum sibiricum*) MYSI | whitestemmed pondweed (*Potamogeton praelongus*) POPR5 | water stargrass (*Zosterella dubia*) ZODU | bur marigold (*Bidens beckii*) BIBE | Robbin's pondweed (*Potamogeton robbins*) PORO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stone Lake | 8/23/07 | 41.615108 | -86.747983 | | 1 | 4.0 | 5 | | | | | | 1 | | | 1 | | | | | | 5 |
| Stone Lake | 8/23/07 | 41.614971 | -86.747951 | | 2 | 6.0 | 5 | | | | | | | | 3 | 3 | | | | | | 5 |
| Stone Lake | 8/23/07 | 41.614455 | -86.747576 | | 3 | 13.0 | 5 | | 5 | | 1 | | 5 | | | | | | 3 | | | |
| Stone Lake | 8/23/07 | 41.614196 | -86.74773 | | 4 | 17.0 | 5 | | 3 | | | | | | | | | | | 3 | | 1 |
| Stone Lake | 8/23/07 | 41.614553 | -86.749543 | | 5 | 3.0 | 5 | | | | | | | | | | | | | | | 5 |
| Stone Lake | 8/23/07 | 41.614269 | -86.749476 | | 6 | 8.0 | 5 | | | | | | 5 | | | | | | 3 | | | 3 |
| Stone Lake | 8/23/07 | 41.613649 | -86.750396 | | 7 | 14.0 | 5 | | 3 | | 1 | | 3 | | 1 | | | | | | | 1 |
| Stone Lake | 8/23/07 | 41.612872 | -86.751187 | | 8 | 18.0 | 1 | | 1 | | | | | | | | | | | | | |
| Stone Lake | 8/23/07 | 41.612011 | -86.752393 | | 9 | 4.0 | 3 | | | | | | | | | | 1 | | | | | 3 |
| Stone Lake | 8/23/07 | 41.611243 | -86.752481 | | 10 | 6.0 | 5 | | | | | | 3 | | 3 | | | | | | | |
| Stone Lake | 8/23/07 | 41.610586 | -86.752276 | | 11 | 12.0 | 5 | | 3 | | 1 | | | | | | | | 1 | | | |
| Stone Lake | 8/23/07 | 41.609842 | -86.751872 | | 12 | 17.0 | 3 | | 3 | | | | | | | | | | | | | |
| Stone Lake | 8/23/07 | 41.60938 | -86.750807 | | 13 | 3.0 | 5 | | 1 | | | | 1 | | 1 | | | | | | | 5 |
| Stone Lake | 8/23/07 | 41.610041 | -86.750143 | | 14 | 7.0 | 5 | | | | | | 3 | | 1 | 3 | | | | | | 1 |
| Stone Lake | 8/23/07 | 41.610484 | -86.749133 | | 15 | 13.0 | 5 | | | | | | 5 | | 3 | | | | | | | 3 |
| Stone Lake | 8/23/07 | 41.611739 | -86.749357 | | 16 | 18.0 | 3 | | 1 | | | | | | | | | | | 1 | | |
| Stone Lake | 8/23/07 | 41.610522 | -86.747919 | | 17 | 4.0 | 5 | | 1 | | | | 1 | 1 | | 1 | | | | | 1 | 1 |
| Stone Lake | 8/23/07 | 41.610701 | -86.746756 | | 18 | 6.0 | 5 | | 1 | | | | 3 | | 1 | 3 | | | | | | 5 |
| Stone Lake | 8/23/07 | 41.610805 | -86.74632 | | 19 | 16.0 | 5 | 1 | 1 | | 3 | | 5 | 1 | 3 | | | | | | 1 | 5 |
| Stone Lake | 8/23/07 | 41.610783 | -86.745538 | | 20 | 6.0 | 5 | | | | | | 3 | | 1 | 5 | 5 | | | | | 1 |
| Stone Lake | 8/23/07 | 41.610469 | -86.744681 | | 21 | 3.0 | 5 | | | | | | 3 | | 3 | | | | | | 1 | 3 |
| Stone Lake | 8/23/07 | 41.611319 | -86.744988 | | 22 | 12.0 | 5 | | | | | | 3 | | 5 | | | | | | | |
| Stone Lake | 8/23/07 | 41.611883 | -86.744252 | | 23 | 12.0 | 5 | 3 | 1 | | | | 5 | | | | 1 | | | | | 3 |
| Stone Lake | 8/23/07 | 41.612401 | -86.74342 | | 24 | 4.0 | 5 | | | | 5 | | 3 | 1 | 1 | 1 | 5 | | | | | 1 |
| Stone Lake | 8/23/07 | 41.613189 | -86.744244 | | 25 | 7.0 | 5 | 1 | | | | | | | 1 | 5 | | | | | | 5 |
| Stone Lake | 8/23/07 | 41.61371 | -86.743562 | | 26 | 4.0 | 3 | | | 1 | 1 | | 1 | | | | 3 | | | | | 1 |
| Stone Lake | 8/23/07 | 41.614398 | -86.744432 | | 27 | 6.0 | 5 | | | | | | 1 | | | 5 | | | | | | 5 |
| Stone Lake | 8/23/07 | 41.614042 | -86.745336 | | 28 | 12.0 | 5 | 1 | | | | | 1 | | 1 | 1 | | | | | | 5 |
| Stone Lake | 8/23/07 | 41.614505 | -86.743614 | | 29 | 6.0 | 5 | | | | | | 3 | | 1 | 5 | 3 | | | | 1 | 1 |
| Stone Lake | 8/23/07 | 41.613908 | -86.742979 | | 30 | 2.0 | 3 | | | | 3 | | 1 | | | | | | | | | |
| Stone Lake | 8/23/07 | 41.613535 | -86.742048 | | 31 | 3.0 | 5 | | | | 3 | | 3 | 1 | | 1 | 3 | | 1 | | | 1 |
| Stone Lake | 8/23/07 | 41.614217 | -86.741242 | | 32 | 7.0 | 5 | | | | | | 3 | | 3 | 3 | 1 | | 3 | | 1 | 3 |
| Stone Lake | 8/23/07 | 41.615125 | -86.741566 | | 33 | 18.0 | 0 | | | | | | | | | | | | | | | |
| Stone Lake | 8/23/07 | 41.61556 | -86.740942 | | 34 | 2.0 | 5 | | | | 3 | | | | 1 | | 3 | | | | | |
| Stone Lake | 8/23/07 | 41.616283 | -86.741866 | | 35 | 18.0 | 1 | | 1 | | | | | | | | | 1 | | | 1 | |
| Stone Lake | 8/23/07 | 41.616629 | -86.742212 | | 36 | 10.0 | 0 | | | | | | | | | | | | | | | |
| Stone Lake | 8/23/07 | 41.616632 | -86.743329 | | 37 | 14.0 | 1 | | 1 | | | | | | | | | | | | | |
| Stone Lake | 8/23/07 | 41.616291 | -86.744277 | | 38 | 14.0 | 5 | 5 | 1 | | | | | | 1 | | | | | | | |
| Stone Lake | 8/23/07 | 41.61679 | -86.744803 | | 39 | 3.0 | 5 | | | | | | | | | | | | | | 1 | 5 |
| Stone Lake | 8/23/07 | 41.615856 | -86.745029 | | 40 | 7.0 | 5 | | | | | 1 | 5 | | | 1 | 5 | | | | 1 | 5 |
| Stone Lake | 8/23/07 | 41.615192 | -86.745629 | | 41 | 7.0 | 5 | | 3 | | | | | | | 3 | 1 | 1 | | | | 5 |
| Stone Lake | 8/23/07 | 41.615834 | -86.746559 | | 42 | 4.0 | 5 | | | | | | 3 | | 3 | | | | 5 | | | |
| Stone Lake | 8/23/07 | 41.615193 | -86.746885 | | 43 | 11.0 | 5 | | 1 | | | | 3 | | 5 | | | | 1 | | | |
| Stone Lake | 8/23/07 | 41.614956 | -86.746852 | | 44 | 20.0 | 1 | | 1 | | | | | | | | | | | | | 1 |
| Stone Lake | 8/23/07 | 41.615375 | -86.747621 | | 45 | 3.0 | 5 | | | | 3 | | 3 | | 1 | | | | 3 | | | |
| Stone Lake | 8/23/07 | 41.61508 | -86.747411 | | 46 | 6.0 | 5 | | 1 | | | | 3 | | | 5 | | | 1 | | | 5 |
| Stone Lake | 8/23/07 | 41.614033 | -86.748895 | | 47 | 20.0 | 1 | | 1 | | | | | | | | | 1 | | | | |
| Stone Lake | 8/23/07 | 41.614154 | -86.74899 | | 48 | 15.0 | 1 | | 1 | | | | | | | | | | | | | |
| Stone Lake | 8/23/07 | 41.614187 | -86.748311 | | 49 | 16.0 | 3 | 1 | 3 | | | | | | | | | | | | | |

### *16.1.3 Lily Lake*

| | | | | | | Eurasian watermilfoil *(Myriophyllum spicatum)* | curlyleaf pondweed *(Potamogeton crispus)* | common coontail *(Ceratophyllum demersum)* | Slender naiad *(Najas flexilis)* | sago pondweed *(Potamogeton pectinatus)* | small pondweed *(Potamogeton pusillus)* | brittle naiad *(Najas minor)* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Latitude | Longitude | Design | Site | Depth | RAKE | MYSP2 | POCR3 | CEDE4 | NAFL | POPE6 | POPU7 | NAMI |
| 41.613669 | -86.730224 | | 1 | 15.0 | 0 | | | | | | | |
| 41.613118 | -86.730702 | | 2 | 13.0 | 0 | | | | | | | |
| 41.612895 | -86.730887 | | 3 | 3.0 | 5 | | | | 3 | | | 5 |
| 41.612921 | -86.731329 | | 4 | 3.0 | 5 | 3 | | 3 | | | | 5 |
| 41.61267 | -86.731678 | | 5 | 1.0 | 5 | | | 5 | | | | 5 |
| 41.612481 | -86.732048 | | 6 | 3.0 | 5 | | 1 | 5 | | | | 1 |
| 41.61234 | -86.732283 | | 7 | 3.0 | 5 | 3 | | 5 | | | 1 | |
| 41.612047 | -86.732405 | | 8 | 2.0 | 1 | 1 | | 1 | | 1 | | |
| 41.611808 | -86.732774 | | 9 | 4.0 | 3 | 1 | | 3 | | | | 1 |
| 41.611392 | -86.732818 | | 10 | 4.0 | 5 | | | 5 | | | | 1 |
| 41.61096 | -86.732849 | | 11 | 2.0 | 5 | | | 5 | | | | 1 |
| 41.611407 | -86.732991 | | 12 | 4.0 | 5 | 5 | | 5 | | | | 1 |
| 41.612042 | -86.733002 | | 13 | 3.0 | 5 | | | 5 | | | | |
| 41.612509 | -86.733155 | | 14 | 4.0 | 5 | | | 5 | | | | |
| 41.612916 | -86.732767 | | 15 | 3.0 | 5 | 1 | | 5 | | 1 | | 5 |
| 41.612987 | -86.732166 | | 16 | 2.0 | 5 | 1 | | 3 | | | | 5 |
| 41.613126 | -86.731648 | | 17 | 4.0 | 5 | 3 | | 5 | | | | 1 |
| 41.613396 | -86.731094 | | 18 | 6.0 | 5 | 1 | | 5 | | | | |
| 41.613717 | -86.730752 | | 19 | 20.0 | 0 | | | | | | | |
| 41.614222 | -86.730684 | | 20 | 17.0 | 1 | | | 1 | | | | |
| 41.614309 | -86.731183 | | 21 | 10.0 | 5 | | | 5 | | | | |
| 41.613806 | -86.731294 | | 22 | 12.0 | 0 | | | | | | | |
| 41.613505 | -86.731814 | | 23 | 2.0 | 5 | 3 | | 5 | | 3 | | 5 |
| 41.613228 | -86.732395 | | 24 | 3.0 | 5 | 3 | | 5 | | | | |
| 41.613296 | -86.732885 | | 25 | 4.0 | 5 | 5 | | 5 | | | | |
| 41.613655 | -86.732618 | | 26 | 5.0 | 5 | 3 | | 5 | | | 1 | 1 |
| 41.613773 | -86.732189 | | 27 | 3.0 | 5 | 3 | 1 | 5 | | | 1 | 5 |
| 41.614212 | -86.732258 | | 28 | 1.0 | 5 | | | 1 | 1 | | | 5 |
| 41.614037 | -86.732545 | | 29 | 2.0 | 3 | 1 | | 3 | | | | 1 |
| 41.613585 | -86.733087 | | 30 | 5.0 | 5 | | | 1 | | | | 5 |

### 16.1.4 Clear Lake

| Lake | Date | Latitude | Longitude | Design | Site | Depth | RAKE | Eurasian watermilfoil (*Myriophyllum spicatum*) MYSP2 | common coontail (*Ceratophyllum demersum*) CEDE4 | Slender naiad (*Najas flexilis*) NAFL | sago pondweed (*Potamogeton pectinatus*) POPE6 | small pondweed (*Potamogeton pusillus*) POPU7 | American elodea (*Elodea canadensis*) ELCA7 | water stargrass (*Zosterella dubia*) ZODU | brittle naiad (*Najas minor*) NAMI | Illinois pondweed (*Potamogeton illinoensis* POIL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clear Lake | 8/8/07 | 41.622761 | -86.723957 | | 1 | 4.0 | 5 | 5 | | | | 1 | | | 1 | |
| Clear Lake | 8/8/07 | 41.622121 | -86.72359 | | 2 | 5.0 | 5 | 5 | | 1 | | 1 | | | 1 | |
| Clear Lake | 8/8/07 | 41.621485 | -86.722938 | | 3 | 6.0 | 5 | 5 | | | | 1 | | | | |
| Clear Lake | 8/8/07 | 41.620868 | -86.722123 | | 4 | 7.0 | 5 | 5 | 1 | | | | | | | 3 |
| Clear Lake | 8/8/07 | 41.620028 | -86.721181 | | 5 | 6.0 | 5 | 5 | 1 | | | | | | | |
| Clear Lake | 8/8/07 | 41.619247 | -86.720752 | | 6 | 6.0 | 5 | 5 | | | | | | | | |
| Clear Lake | 8/8/07 | 41.618398 | -86.720179 | | 7 | 6.0 | 5 | 5 | 1 | | | | | | | 1 |
| Clear Lake | 8/8/07 | 41.617618 | -86.719543 | | 8 | 4.0 | 5 | 5 | 5 | | | | | | | |
| Clear Lake | 8/8/07 | 41.616904 | -86.720509 | | 9 | 4.0 | 5 | 5 | 5 | | | | | | | |
| Clear Lake | 8/8/07 | 41.617756 | -86.721576 | | 10 | 5.0 | 5 | 5 | | | | | | | | |
| Clear Lake | 8/8/07 | 41.618832 | -86.722345 | | 11 | 6.0 | 5 | 5 | 1 | 1 | | | | | | |
| Clear Lake | 8/8/07 | 41.619899 | -86.722985 | | 12 | 6.0 | 5 | 5 | 1 | | | | | 5 | | 5 |
| Clear Lake | 8/8/07 | 41.620912 | -86.723822 | | 13 | 5.0 | 5 | 5 | | | | | | | | 5 |
| Clear Lake | 8/8/07 | 41.621319 | -86.724649 | | 14 | 3.0 | 5 | 5 | | | | 1 | | 1 | 1 | |
| Clear Lake | 8/8/07 | 41.620076 | -86.724492 | | 15 | 3.0 | 5 | 5 | | | | | 1 | 5 | | 5 |
| Clear Lake | 8/8/07 | 41.619338 | -86.723616 | | 16 | 5.0 | 5 | 5 | | | | | | | | |
| Clear Lake | 8/8/07 | 41.618221 | -86.723189 | | 17 | 4.0 | 5 | 5 | | | | 1 | | | | |
| Clear Lake | 8/8/07 | 41.617348 | -86.722707 | | 18 | 5.0 | 5 | 5 | | | | | | | | |
| Clear Lake | 8/8/07 | 41.616517 | -86.722794 | | 19 | 8.0 | 3 | 1 | 3 | | | | | | | |
| Clear Lake | 8/8/07 | 41.618978 | -86.724311 | | 20 | 3.0 | 5 | 5 | | | | | | | 1 | 1 |
| Clear Lake | 8/8/07 | 41.619493 | -86.725371 | | 21 | 2.0 | 5 | 5 | 1 | | | | 1 | | | |
| Clear Lake | 8/8/07 | 41.620516 | -86.724928 | | 22 | 5.0 | 5 | 3 | | | | | | | 5 | |
| Clear Lake | 8/8/07 | 41.622198 | -86.724272 | | 23 | 3.0 | 5 | 5 | 1 | | | | | | 1 | |
| Clear Lake | 8/8/07 | 41.623412 | -86.723079 | | 24 | 3.0 | 5 | 5 | | 1 | | 1 | | | | 1 |
| Clear Lake | 8/8/07 | 41.622773 | -86.722487 | | 25 | 6.0 | 5 | 5 | | | | 1 | | | | |
| Clear Lake | 8/8/07 | 41.621961 | -86.72181 | | 26 | 6.0 | 5 | 5 | 1 | | | | | | | |
| Clear Lake | 8/8/07 | 41.621264 | -86.721153 | | 27 | 7.0 | 5 | 5 | 1 | | | | | | | |
| Clear Lake | 8/8/07 | 41.620606 | -86.720566 | | 28 | 8.0 | 5 | 5 | | | | | | | | |
| Clear Lake | 8/8/07 | 41.6201 | -86.720155 | | 29 | 7.0 | 5 | 5 | | | | | | | | |
| Clear Lake | 8/8/07 | 41.619407 | -86.719777 | | 30 | 6.0 | 5 | 5 | | | | | | | | |
| Clear Lake | 8/8/07 | 41.618603 | -86.719116 | | 31 | 6.0 | 5 | 5 | 3 | | | | | | | |
| Clear Lake | 8/8/07 | 41.61802 | -86.718562 | | 32 | 3.0 | 5 | 5 | 5 | | | | | | | |
| Clear Lake | 8/8/07 | 41.618679 | -86.718234 | | 33 | 5.0 | 5 | 5 | 5 | | | | | | | |
| Clear Lake | 8/8/07 | 41.619568 | -86.718508 | | 34 | 5.0 | 5 | 5 | 3 | | | | | | | |
| Clear Lake | 8/8/07 | 41.620376 | -86.71906 | | 35 | 4.0 | 5 | 5 | | | | | | 1 | 1 | |
| Clear Lake | 8/8/07 | 41.621276 | -86.719527 | | 36 | 5.0 | 5 | 5 | 3 | | | | | | | |
| Clear Lake | 8/8/07 | 41.622046 | -86.720207 | | 37 | 6.0 | 5 | 5 | 1 | | | | | | | |
| Clear Lake | 8/8/07 | 41.622608 | -86.721022 | | 38 | 6.0 | 5 | 5 | 3 | | | | | | | 1 |
| Clear Lake | 8/8/07 | 41.623479 | -86.722059 | | 39 | 4.0 | 5 | 5 | | | | | | | 3 | |
| Clear Lake | 8/8/07 | 41.623402 | -86.721151 | | 40 | 5.0 | 5 | 5 | 1 | | | 1 | 1 | | | |
| Clear Lake | 8/8/07 | 41.623118 | -86.720268 | | 41 | 4.0 | 5 | 5 | 3 | | | | | | | |
| Clear Lake | 8/8/07 | 41.622281 | -86.719505 | | 42 | 4.0 | 5 | 5 | | | | | | | 5 | |
| Clear Lake | 8/8/07 | 41.62107 | -86.71923 | | 43 | 3.0 | 3 | 1 | | 1 | | 1 | | | 1 | |
| Clear Lake | 8/8/07 | 41.620114 | -86.718578 | | 44 | 3.0 | 3 | 1 | | 1 | | | | | 1 | |
| Clear Lake | 8/8/07 | 41.617616 | -86.718901 | | 45 | 3.0 | 5 | 1 | | | | | | | 5 | |
| Clear Lake | 8/8/07 | 41.617159 | -86.719745 | | 46 | 3.0 | 3 | 3 | 1 | | 1 | | | 1 | | |
| Clear Lake | 8/8/07 | 41.616584 | -86.721357 | | 47 | 4.0 | 5 | 5 | 1 | | | | | | | |
| Clear Lake | 8/8/07 | 41.617263 | -86.721901 | | 48 | 6.0 | 5 | 5 | 3 | 1 | | 1 | | | | |
| Clear Lake | 8/8/07 | 41.618808 | -86.721564 | | 49 | 6.0 | 5 | 5 | | | | | | | | |

# 16.2 IDNR VEGETATION PERMIT

## *16.2.1 2008 Pine Lake Permit*

| | | |
|---|---|---|
| **APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT**<br>State Form 26727 (R / 11-03)<br>Approved State Board of Accounts 1987<br>[ ] Whole Lake [x] Multiple Treatment Areas<br>Check type of permit | **FOR OFFICE USE ONLY**<br>License No.<br>Date Issued<br>Lake County | *Return to:* Page 1 of 2<br>DEPARTMENT OF NATURAL RESOURCES<br>Division of Fish and Wildlife<br>Commercial License Clerk<br>402 West Washington Street, Room W273<br>Indianapolis, IN 46204 |
| *INSTRUCTIONS: Please print or type information* | | FEE: $5.00 |

| | | |
|---|---|---|
| Applicant's Name: Casey Sullivan | Lake Assoc. Name: City of Laporte | |
| Rural Route or Street: 250 Pine Lake Avenue | | Phone Number: 219-326-9600 |
| City and State: LaPorte, IN | | ZIP Code: 46350 |
| Certified Applicator (if applicable) | Company or Inc. Name | Certification Number |
| Rural Route or Street | | Phone Number |
| City and State | | ZIP Code |
| Lake (One application per lake): Pine Lake | Nearest Town: LaPorte | County: LaPorte |
| Does water flow into a water supply | | [ ] Yes [x] No |

**Please complete one section for *EACH* treatment area. Attach lake map showing treatment area and denote location of any water supply intake.**

| | | | | | |
|---|---|---|---|---|---|
| Treatment Area # | 1 | LAT/LONG or UTM's | Milfoil where it occurs (Areas determined after LARE survey) | | |
| Total acres to be controlled | | Proposed shoreline treatment length (ft) | | Perpendicular distance from shoreline (ft) | |
| Maximum Depth of Treatment (ft) | | Expected date(s) of treatment(s) | mid to late may | | |
| Treatment method: | [X] Chemical | [ ] Physical | [ ] Biological Control | [ ] Mechanical | |

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Renovate and/or 2,4-D for selective control of Eurasian watermilfoil

Plant survey method: [x] Rake [x] Visual [ ] Other (specify) 2007 summer t2 survey

| Aquatic Plant Name | Check if Target Species | Relative Abundance % of Community |
|---|---|---|
| Eel grass | | 15 |
| coontail | | 10 |
| Eurasian watermilfoil | x | 10 |
| Richardson's pondweed | | 1 |
| Variable pondweed | | 10 |
| Bur-marigold | | 2 |
| northern watermilfoil | | 10 |
| Chara spp. | | 1 |
| elodea | | 10 |
| slender naiad | | 10 |
| Whitestem pondweed | | 10 |
| largeleaf pondweed | | 1 |
| Whitestem pondweed | | 5 |
| Water stargrass | | 4 |
| Robbin's pondweed | | 5 |

Page 2 of 2

| | | | | | |
|---|---|---|---|---|---|
| Treatment Area # | | LAT/LONG or UTM's | | | |
| Total acres to be controlled | | Proposed shoreline treatment length (ft) | | Perpendicular distance from shoreline (ft) | |
| Maximum Depth of Treatment (ft) | | Expected date(s) of treatment(s) | | | |

Treatment method: ☐ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control.

Plant survey method: ☐ Rake ☐ Visual ☐ Other (specify)

| Aquatic Plant Name | Check if Target Species | Relative Abundance % of Community |
|---|---|---|
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*INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.*

| | |
|---|---|
| Applicant Signature | Date |
| Certified Applicant's Signature | Date |

**FOR OFFICE ONLY**

| | |
|---|---|
| ☐ Approved ☐ Disapproved | Fisheries Staff Specialist |
| ☐ Approved ☐ Disapproved | Environmental Staff Specialist |

Mail check or money order in the amount of $5.00 to:

**DEPARTMENT OF NATURAL RESOURCES**
DIVISION OF FISH AND WILDLIFE
COMMERCIAL LICENSE CLERK
402 WEST WASHINGTON STREET ROOM W273
INDIANAPOLIS, IN 46204

### 16.2.2 2008 Stone Lake Permit

| | | |
|---|---|---|
| **APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT**<br>State Form 26727 (R / 11-03)<br>Approved State Board of Accounts 1987<br>[ ] Whole Lake [x] Multiple Treatment Areas<br>Check type of permit | **FOR OFFICE USE ONLY**<br>License No.<br>Date Issued<br>Lake County | *Return to:* Page 1 of 2<br>DEPARTMENT OF NATURAL RESOURCES<br>Division of Fish and Wildlife<br>Commercial License Clerk<br>402 West Washington Street, Room W273<br>Indianapolis, IN 46204 |
| *INSTRUCTIONS: Please print or type information* | | FEE: $5.00 |

| | | |
|---|---|---|
| Applicant's Name: Casey Sullivan | Lake Assoc. Name: City of Laporte | |
| Rural Route or Street: 250 Pine Lake Avenue | | Phone Number: 219-326-9600 |
| City and State: LaPorte, IN | | ZIP Code: 46350 |
| Certified Applicator (if applicable): | Company or Inc. Name: | Certification Number: |
| Rural Route or Street: | | Phone Number: |
| City and State: | | ZIP Code: |
| Lake (One application per lake): Stone Lake | Nearest Town: LaPorte | County: LaPorte |
| Does water flow into a water supply | | [ ] Yes [x] No |

**Please complete one section for *EACH* treatment area. Attach lake map showing treatment area and denote location of any water supply intake.**

| | | | |
|---|---|---|---|
| Treatment Area #: 1 | LAT/LONG or UTM's: Milfoil where it occurs (Areas determined after LARE survey) | | |
| Total acres to be controlled: | Proposed shoreline treatment length (ft): | Perpendicular distance from shoreline (ft): | |
| Maximum Depth of Treatment (ft): | Expected date(s) of treatment(s): mid to late May | | |
| Treatment method: [X] Chemical | [ ] Physical | [ ] Biological Control | [ ] Mechanical |

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Renovate and/or 2,4-D for selective control of Eurasian watermilfoil

Plant survey method: [x] Rake [x] Visual [ ] Other (specify)

| Aquatic Plant Name | Check if Target Species | Relative Abundance % of Community |
|---|---|---|
| Eurasian watermiloil | x | 1 |
| Water Stargrass | | 1 |
| Common coontail | | 13 |
| Common naiad | | 5 |
| Water marigold | | 5 |
| Chara | | 1 |
| Elodea | | 5 |
| Northern milfoil | | 1 |
| Nitella | | 1 |
| Largeleaf pondweed | | 10 |
| Curlyleaf pondweed | | 1 |
| Fries pondweed | | 2 (continued on next page) |

Page 2 of 2

| | | | | | |
|---|---|---|---|---|---|
| Treatment Area # | 1 continued | LAT/LONG or UTM's | | | |
| Total acres to be controlled | | Proposed shoreline treatment length (ft) | | Perpendicular distance from shoreline (ft) | |
| Maximum Depth of Treatment (ft) | | Expected date(s) of treatment(s) | | | |

Treatment method: ☐ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control.

Plant survey method: ☐ Rake ☐ Visual ☐ Other (specify) AREA 1 CONTINUED

| Aquatic Plant Name | Check if Target Species | Relative Abundance % of Community |
|---|---|---|
| Variable pondweed | | 5 |
| Whitestem pondweed | | 5 |
| Robbins pondweed | | 10 |
| Stiff pondweed | | 1 |
| Flatstem pondweed | | 15 |
| Water Crowfoot | | 1 |
| Horned pondweed | | 1 |
| Eel grass | | 15 |
| Arrowhead | | 1 |
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*INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.*

| | |
|---|---|
| Applicant Signature | Date |
| Certified Applicant's Signature | Date |

**FOR OFFICE ONLY**

| | |
|---|---|
| ☐ Approved ☐ Disapproved | Fisheries Staff Specialist |
| ☐ Approved ☐ Disapproved | Environmental Staff Specialist |

Mail check or money order in the amount of $5.00 to:

**DEPARTMENT OF NATURAL RESOURCES**
DIVISION OF FISH AND WILDLIFE
COMMERCIAL LICENSE CLERK
402 WEST WASHINGTON STREET ROOM W273
INDIANAPOLIS, IN 46204

## 16.2.3 Lily Lake Permit

| | | |
|---|---|---|
| **APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT**<br>State Form 26727 (R / 11-03)<br>Approved State Board of Accounts 1987<br>[ ] Whole Lake [x] Multiple Treatment Areas<br>Check type of permit | **FOR OFFICE USE ONLY**<br>License No.<br>Date Issued<br>Lake County | *Return to:* Page 1 of 2<br>DEPARTMENT OF NATURAL RESOURCES<br>Division of Fish and Wildlife<br>Commercial License Clerk<br>402 West Washington Street, Room W273<br>Indianapolis, IN 46204 |
| *INSTRUCTIONS: Please print or type information* | | FEE: $5.00 |

| | | |
|---|---|---|
| Applicant's Name: Casey Sullivan | Lake Assoc. Name: City of Laporte | |
| Rural Route or Street: 250 Pine Lake Avenue | | Phone Number: 219-326-9600 |
| City and State: LaPorte, IN | | ZIP Code: 46350 |
| Certified Applicator (if applicable) | Company or Inc. Name | Certification Number |
| Rural Route or Street | | Phone Number |
| City and State | | ZIP Code |
| Lake (One application per lake): Lily Lake | Nearest Town: LaPorte | County: LaPorte |
| Does water flow into a water supply | | [ ] Yes [x] No |

**Please complete one section for *EACH* treatment area. Attach lake map showing treatment area and denote location of any water supply intake.**

| | | | | | |
|---|---|---|---|---|---|
| Treatment Area # | 1 | LAT/LONG or UTM's | Milfoil where it occurs (Areas determined after LARE survey on 8/9/07) | | |
| Total acres to be controlled | | Proposed shoreline treatment length (ft) | | Perpendicular distance from shoreline (ft) | |
| Maximum Depth of Treatment (ft) | | Expected date(s) of treatment(s) | mid to late May | | |

Treatment method: [X] Chemical [ ] Physical [ ] Biological Control [ ] Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Renovate and/or 2,4-D for selective control of Eurasian watermilfoil

Plant survey method: [x] Rake [x] Visual [ ] Other (specify)

| Aquatic Plant Name | Check if Target Species | Relative Abundance % of Community |
|---|---|---|
| Eurasian watermiloil | x | 20 |
| Water Stargrass | | 5 |
| Common coontail | | 55 |
| Brittle naiad | | 15 |
| Bladderwort | | 5 |
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Page 2 of 2

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|---|---|---|---|---|---|
| Treatment Area # | | LAT/LONG or UTM's | | | |
| Total acres to be controlled | | Proposed shoreline treatment length (ft) | | Perpendicular distance from shoreline (ft) | |
| Maximum Depth of Treatment (ft) | | Expected date(s) of treatment(s) | | | |

Treatment method: ☐ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control.

Plant survey method: ☐ Rake ☐ Visual ☐ Other (specify)

| Aquatic Plant Name | Check if Target Species | Relative Abundance % of Community |
|---|---|---|
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*INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.*

| | |
|---|---|
| Applicant Signature | Date |
| Certified Applicant's Signature | Date |

**FOR OFFICE ONLY**

| | |
|---|---|
| ☐ Approved ☐ Disapproved | Fisheries Staff Specialist |
| ☐ Approved ☐ Disapproved | Environmental Staff Specialist |

Mail check or money order in the amount of $5.00 to:

**DEPARTMENT OF NATURAL RESOURCES**
DIVISION OF FISH AND WILDLIFE
COMMERCIAL LICENSE CLERK
402 WEST WASHINGTON STREET ROOM W273
INDIANAPOLIS, IN 46204

### *16.2.4 Clear Lake Permit*

| | | |
|---|---|---|
| **APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT**<br>State Form 26727 (R / 11-03)<br>Approved State Board of Accounts 1987<br>x Whole Lake ☐ Multiple Treatment Areas<br>Check type of permit | **FOR OFFICE USE ONLY**<br>License No.<br><br>Date Issued<br><br>Lake County | *Return to:* Page **1** of **2**<br>DEPARTMENT OF NATURAL RESOURCES<br>Division of Fish and Wildlife<br>Commercial License Clerk<br>402 West Washington Street, Room W273<br>Indianapolis, IN 46204<br><br>FEE: $5.00 |

*INSTRUCTIONS: Please print or type information*

| | | |
|---|---|---|
| Applicant's Name: Casey Sullivan | Lake Assoc. Name: City of Laporte | |
| Rural Route or Street: 250 Pine Lake Avenue | | Phone Number: 219-326-9600 |
| City and State: LaPorte, IN | | ZIP Code: 46350 |
| Certified Applicator (if applicable): | Company or Inc. Name: | Certification Number: |
| Rural Route or Street: | | Phone Number: |
| City and State: | | ZIP Code: |
| Lake (One application per lake): Clear Lake | Nearest Town: LaPorte | County: LaPorte |
| Does water flow into a water supply | | ☐ Yes x No |

**Please complete one section for *EACH* treatment area. Attach lake map showing treatment area and denote location of any water supply intake.**

| | | | | | |
|---|---|---|---|---|---|
| Treatment Area # | 1 | LAT/LONG or UTM's | Whole Lake Fluridone Treatment | | |
| Total acres to be controlled | 97 | Proposed shoreline treatment length (ft) | | Perpendicular distance from shoreline (ft) | |
| Maximum Depth of Treatment (ft) | | Expected date(s) of treatment(s) | late April to early May | | |

Treatment method: X Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Sonar AS initial 6 ppb hold to 2 ppb for 90-120 days

Plant survey method: x Rake x Visual ☐ Other (specify)

| Aquatic Plant Name | Check if Target Species | Relative Abundance % of Community |
|---|---|---|
| Eurasian watermiloil | x | 75 |
| Brittle naiad | | 5 |
| Common coontail | | 5 |
| Chara | | 1 |
| Elodea | | 1 |
| Water stargrass | | 1 |
| American lotus | | 1 |
| Curlyleaf pondweed | | 1 |
| Illinois pondweed | | 6 |
| Small pondweed | | 1 |
| Water crowfoot | | 1 |
| Spatterdock | | 1 |
| White water lily | | 1 |

Page 2 of 2

| | | | | | |
|---|---|---|---|---|---|
| Treatment Area # | | LAT/LONG or UTM's | | | |
| Total acres to be controlled | | Proposed shoreline treatment length (ft) | | Perpendicular distance from shoreline (ft) | |
| Maximum Depth of Treatment (ft) | | Expected date(s) of treatment(s) | | | |

Treatment method: ☐ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control.

Plant survey method: ☐ Rake ☐ Visual ☐ Other (specify)

| Aquatic Plant Name | Check if Target Species | Relative Abundance % of Community |
|---|---|---|
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*INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.*

| | |
|---|---|
| Applicant Signature | Date |
| Certified Applicant's Signature | Date |

**FOR OFFICE ONLY**

| | |
|---|---|
| ☐ Approved ☐ Disapproved | Fisheries Staff Specialist |
| ☐ Approved ☐ Disapproved | Environmental Staff Specialist |

Mail check or money order in the amount of $5.00 to:

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DIVISION OF FISH AND WILDLIFE
COMMERCIAL LICENSE CLERK
402 WEST WASHINGTON STREET ROOM W273
INDIANAPOLIS, IN 46204

## 16.3 PUBLIC INPUT QUESTIONARE

Lake Use Survey Lake name___________________________

Are you a lake property owner? Yes________ No_________

Are you currently a member of your lake association? Yes ___ No___

How many years have you been at the lake?
2 or less
2 – 5 years
5-10 years
Over 10 years

How do you use the lake (mark all that apply)

___Swimming ___Irrigation
___Boating ___Drinking water
___Fishing ___Other _______________________

Do you have aquatic plants at your shoreline in nuisance quantities? Yes ___ No ___

Do you currently participate in a weed control project on the lake? Yes ___ No ___

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes ___ No___
Does the level of vegetation in the lake affect your property values? Yes ___ No ___

Are you in favor of continuing efforts to control vegetation on the lake? Yes ___ No ___

Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded? Yes ___ No ___

Mark any of these you think are problems on your lake:

___ Too many boats access the lake
___ Use of jet skis on the lake
___ Too much fishing
___ Fish population problem
___ Dredging needed
___ Overuse by nonresidents
___ Too many aquatic plants
___ Not enough aquatic plants
___ Poor water quality
___ Pier/funneling problem

Please add any comments:

________________________________________________________________________

________________________________________________________________________

## 16.4 RESOURCES FOR AQUATIC VEGETATION MANAGEMENT

**Books**

Aquatic Plant Management in Lakes and Reservoirs
Aquatic Plants of Illinois
A Manual of Aquatic Plants
Managing Lakes and Reservoirs
Interactions Between Fish and Aquatic Macrophytes in Inland Waters
Lake and Reservoir Restoration
Aquatic Plant Management-Best Management Practices in Support of Fish and Wildlife

**Societies/Websites**

Aquatic Plant Management Society-www.apms.org
Midwest Aquatic Plant Management Society-www.mapms.org
North American Lake Management Society-www.nalms.org
Indiana Lake Management Society-www.indianalakes.org
Aquatic Ecosystem Restoration Foundation-www.aquatics.org